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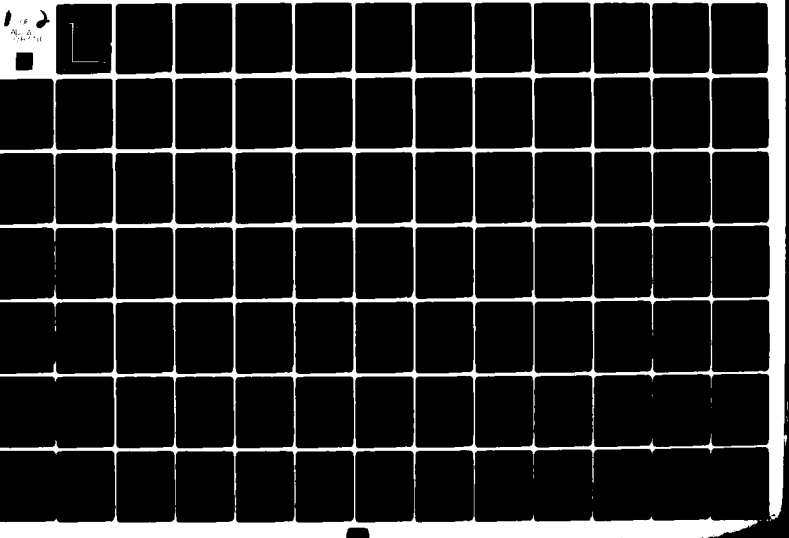


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AIR FORCE HUMAN RESOURCES LABORATORY

METHODS FOR COLLECTING AND ANALYZING TASK ANALYSIS DATA

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Final Report

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235

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This final report was submitted by McDonnell Douglas Astronautics Company–St. Louis, P.O. Box 516, St. Louis, Missouri 63166 under contract F33615-77-C-0076, Project ILIR, with Manpower and Personnel Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base, Texas 78235. Hendrick W. Ruck was the Contract Monitor for the Laboratory.

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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Task analysis, a critical front-end activity in the Instructional System Development methodology, is the process of partitioning job tasks into their component subtasks and identifying the skills and knowledges required to support task performance. This study was initiated in response to a Request for Personnel Research generated by the Air Training Command, which noted that "a wide range of nonstandardized task analysis procedures are in use throughout the training community." Implementation of a standardized procedure for identifying essential subtasks and supporting skills and knowledges was expected to hold considerable potential for increasing training efficiency and reducing training costs. A simplified task analysis procedure and documentation system was specified, and a task analysis handbook was prepared. Handbook procedures were field tested at six Air Force installations. Results

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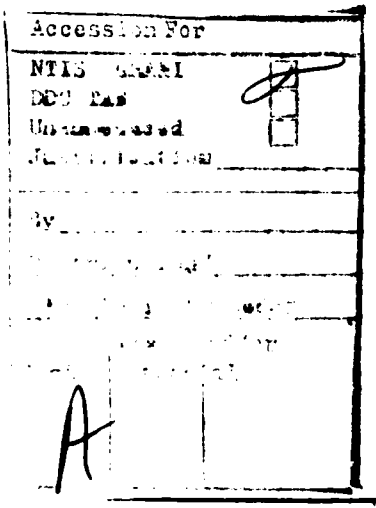
indicated that the handbook procedures met the design criteria of simplicity, validity, reliability, and time-efficiency/cost-effectiveness. The feasibility and utility of implementing a computer-based task analysis data bank was assessed, and a preliminary data bank design was then developed. Additionally, two technology transfer seminars were conducted to assist Air Force personnel in applying handbook task analysis procedures.



EXECUTIVE SUMMARY

Air Force Manual (AFM) 50-2 defines Instructional System Design (ISD) as a "systematic procedure for assuring application of instructional technology to course planning and development." Task analysis, a critical front-end activity in the ISD methodology, is the process of partitioning job tasks into their component subtasks and identifying the skills and knowledges required to support task performance. The output of the task analysis activity may be thought of as a specification which defines the content of an instructional program. Emphasis is placed upon identifying only those skills and knowledges which must be taught to support task performance because overtraining and undertraining are extremely costly and wasteful.

This research was initiated in response to a Request for Personnel Research generated by the Air Training Command (ATC) which noted that "a wide range of nonstandardized task analysis procedures are in use throughout the training community." It was felt that implementation of a standardized procedure for identifying essential subtasks and supporting skills and knowledges held considerable potential for increasing training efficiency and reducing training costs.

In Phase I, ATC training development and management personnel and their counterparts within the Military Airlift Command (MAC), the Strategic Air Command (SAC), and the Tactical Air Command (TAC) were interviewed regarding task analysis procedures currently in use. Twenty-five groups, ranging in size from two to nine individuals, at eight Air Force (AF) installations participated in the survey. Current ATC task analysis procedures and ISD training and guidance documentation were reviewed and evaluated. Recommendations for improving the ATC task analysis effort included developing and field testing a simplified task analysis procedure and documentation system.

In Phase II, a standardized task analysis procedure was specified and a prototype task analysis handbook was prepared. A two-stage field test was conducted. Stage 1 consisted of preliminary tryouts conducted to obtain information useful for revising the handbook prior to formal evaluation. Thirty-five training development personnel at three AF bases either utilized the prototype procedures to conduct a task analysis or critically reviewed the handbook. A sizable number of suggestions for improving the handbook were generated and numerous revisions were made. Stage 2, feasibility testing, was devoted to assessing the simplicity, reliability, validity, and time-efficiency of handbook task analysis procedures. Sixty-five training development personnel at three ATC Technical Training Centers (TTCs) participated in feasibility testing. Some utilized handbook procedures to conduct task analyses, others reviewed and critiqued the handbook. A substantial majority of the participants felt that the handbook procedures were simple to use and would require less time to complete than the current procedures. More importantly, evaluation of completed task analyses indicated that handbook procedures were reliable and valid.

In Phase III, a final draft of the task analysis handbook was prepared, reviewed in conference with intended users and ATC management personnel, and revised. The handbook has been published as AFHRL-TR-79-45 (II). A preliminary design for an automated storage and retrieval system for ATC task analysis documentation was then prepared. Additionally, two technology transfer seminars were conducted to assist AF personnel in applying handbook task analysis procedures.

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SECTION I

INTRODUCTION

BACKGROUND

Since the AF developed its first major instructional system in 1965, the systems approach to training has received considerable emphasis within the Department of Defense and in the civilian sector. The issuance of AF Manual (AFM) 50-2, Instructional System Design, AF Pamphlet (AFP) 50-58, Handbook for Designers of Instructional Systems, and AF Regulation 50-8, Instructional Systems Development (ISD), witnessed a realization on the part of the AF that application of modern instructional technologies might yield substantial improvements in the effectiveness and efficiency of AF training programs. These documents place considerable emphasis on achieving close correspondence between training program content and job performance requirements.

The Occupational Surveys (OSs) produced by the USAF Occupational Measurement Center (OMC) are an important information source for accomplishing job analysis and specifying job performance requirements within the context of AF technical training. However, more detailed information about job performance subtasks and supporting skills and knowledges is required to design effective and efficient training programs. Task analysis, the process by which that detailed information is generated, is the most important step in designing an instructional system. The process by which a skilled instructional designer identifies the major procedural steps within a task and then makes inferences about required skills and knowledges is not well defined. Additionally, those in the ATC who are responsible for conducting and documenting task analyses are Subject-Matter Specialists (SMSs), not educational technologists. The implementation of a simplified task analysis procedure/documentation system and of a computer-based task analysis data bank may offer significant economies in the design and revision of technical training courses. A standardized task analysis procedure would help insure that course content decisions are made on the basis of job performance requirements as tempered by training situation constraints; and a computer-based data bank would provide a means of storing, retrieving, updating, and disseminating current task analysis information. Ultimately, these economies might be expected to manifest themselves in the form of more effective and less costly training.

STUDY OBJECTIVES AND APPROACH

The primary objective of this study was to develop and field test a simple-to-use, reliable, valid, and cost-effective/time-efficient task analysis procedure for application by the ATC training development personnel responsible for the design and conduct of technical training courses. A secondary objective was to make recommendations regarding the feasibility and utility of implementing a computer-based task analysis data bank and to submit a preliminary data bank design for consideration. End items included:

1. A handbook detailing a standardized task analysis procedure that will provide an acceptable degree of uniformity and quality control across ATC task analysis efforts.

2. A systems analysis of present and future AF task analysis requirements, including a preliminary design for a task analysis data bank.

The investigative approach employed in this study was straightforward. In Phase I, current ATC task analysis procedures were characterized and evaluated. Recommendations for improving the task analysis effort were then proposed. In Phase II, a standardized procedure was specified and a prototype handbook was developed. It was field tested at ATC TTCs and revised on the basis of field test results. In Phase III, a final draft of the task analysis handbook was prepared, reviewed in conference with intended users and management personnel, and revised prior to finalization. A preliminary plan for an automated storage and retrieval system for task analysis data was then developed. Additionally, two technology transfer seminars were conducted to assist AF personnel in applying handbook task analysis procedures. It should be noted that ATC training development and management personnel were continuously involved in the design, testing, and revision of the handbook to insure that it was useful, and to maximize the probability that it would be accepted and implemented.

GLOSSARY OF TERMS

A glossary of technical terms and their acronyms used in this report is presented in Appendix H.

SECTION II

SURVEY OF CURRENT TASK ANALYSIS PROCEDURES

METHOD

Interviews

Research interviews were conducted to gain insight into the task analysis procedures currently being utilized in the AF technical training community. The interview consisted of a set of specific questions, each with an open response set. Also known as the open-ended or free-response format, this type of interview was chosen because it insures that relevant areas of inquiry are addressed in sufficient depth, by permitting interviewees to respond freely and to elaborate in their own words. It also allows the interviewer to selectively probe more deeply into interesting and novel responses. Further, the informal atmosphere created by this type of interview encourages interviewees to be both cooperative and candid.

Development of the Interview

Prior to developing the interview, a review of current military and civilian task analysis procedures and manuals was accomplished. In addition, conferences and discussions were held with cognizant personnel from the sponsoring agency and ATC. Based upon these meetings and the document review, the following specific areas of inquiry were identified for inclusion in the interview:

1. The relative percentage of time spent revising existing courses versus developing new courses and manpower/resource expenditure accounting.

2. The process utilized for determining tasks which require instruction.

3. The process utilized for determining proficiency requirements.

4. The manner in which OS and Occupational Survey Report (OSR) data are utilized.

5. The procedures used for subtask identification.

6. The procedures used for skill/knowledge analyses.

7. The manner in which subtask and skill/knowledge analyses are validated (verified).

8. The adequacy of reviews, student critiques, and field evaluations for determining training inadequacy/excessiveness.

9. The familiarity with and judged adequacy of AFM 50-2, AFP 50-58 and the Interservice Procedures for Instructional System Development (IPISD).

10. The extent of formal training in ISD and its judged adequacy.

11. The overall opinions regarding the AF ISD program.

12. The problems associated with implementing the AF ISD model.

In addition to the interview, a decision was made to secure copies of task analysis and ISD worksheets and locally produced ISD guidance documents, when interviewees indicated that a formal documentation system or local procedures were utilized.

Pretest of the Interview

The interview in its original form, was pretested on training managers, training specialists and SMSs at Sheppard TTC. This pretesting indicated necessary refinements. Certain questions were redundant and, therefore, eliminated. Other questions required rephrasing for the purpose of enhancing clarity. Finally, the pretest indicated that a reordering of some of the questions was necessary in order to obtain continuity in the flow of thoughts and ideas that were being elicited from the interviewees.

Conduct of the Interviews

Three interviewers, all members of the Engineering Psychology Department of McDonnell Douglas Astronautics Company - St. Louis (MDAC-St. Louis), collected the data in the field. Each of these interviewers had extensive experience in both structured and unstructured interviewing. In addition, each interviewer was generally familiar with the AF ISD program and had reviewed pertinent documentation in the area of task analysis.

Those interviewed included a full range of training development personnel, including military and civilian education specialists, ISD technicians, and master instructors who had been, or were currently, involved with task analysis efforts at the five ATC TTCs. In addition, training development personnel from the 3306th Test and Evaluation Squadron at Edwards Air Force (AFB); the USAF School of Aerospace Medicine, Brooks AFB; and the School of Health Care Sciences, Sheppard AFB, were also interviewed. Finally, training development personnel from the MAC, the TAC, and the SAC were interviewed regarding their current ISD and task analysis efforts.

Review of ISD Guidance Documentation

In addition to soliciting the opinions of training development personnel regarding the ISD and task analysis guidance provided in AFM 50-2 and AFP 50-58, the study team conducted an independent review and

assessment of these documents. This assessment, necessarily subjective, was conducted along two primary dimensions:

1. The inherent logic of AF task analysis procedures and the ISD model in which they are embedded.

2. The usability and readability of the manual and pamphlet that document those procedures and that model.

The issue dates for the documents reviewed were 31 July 1975 for AFM 50-2, and 15 July 1973 for AFP 50-58. It should be noted that both documents have subsequently been revised by ATC based on field survey results.

Review of AF ISD Courses

The assessment of AF ISD training was based upon a review of course control documents and student study guides and workbooks furnished by the Instructor Training Branch of the 3700th Technical Training Wing, Sheppard AFB. Specific courses examined included: 3AIR75100, Technical Instructor, and 3AIR75130-X, Instructional System Development. The primary intent of the review was to evaluate AF ISD training generally but with particular emphasis on those instructional units dealing specifically with task analysis. A secondary objective was to generate an information base for judging the validity of course graduate comments gathered during the on-site interviews.

Course (unit) review criteria clustered along three major dimensions:

1. The clarity and appropriateness of instructional objectives.

2. The adequacy of the information and practice exercises presented.

3. The clarity of the interrelationships among major concepts.

A truly rigorous evaluation of AF ISD training courses would, of course, have required attendance at and active participation in each of the subject courses. Unfortunately, budget constraints did not permit this type of evaluation.

RESULTS

Current Procedures Survey: Technical Training Centers

Relative Percentage of Time Spent Revising Existing Courses Versus Developing New Courses

- Of the time spent in task analysis activities, the overwhelming proportion was expended in accomplishing analyses to support revision of existing courses.

- Training development personnel deemed existing task analysis procedures more useful for developing new courses than for revising existing courses.

Manpower/Resource Expenditure Accounting

- Training managers and training development personnel did not record time spent or number of personnel involved in task analysis (or ISD) efforts.

Determination of Which Tasks Require Training

- Training development personnel assumed that all tasks listed in the Speciality Training Standard (STS) or Course Training Standard (CTS) required training.

- The OS was a supplementary source of information used to "verify" STS/CTS lists.

Determination of Proficiency Requirements

- Training development personnel examined and interpreted STS/CTS proficiency codes to define required proficiency levels.

- A few training development groups utilized the task difficulty data in the OS to determine proficiency requirements.

Use of OS in Task Analysis Process

- A majority of training development personnel indicated that OS information was useful in performing task analysis.

- Most of those interviewed expressed concern about the currency and validity of OSs.

- Most groups were unaware of the special purpose OS analyses that can be accomplished by the OMC.

Subtask Identification

- Instructor and SMS experience was considered the most important source of information for breaking a major task into its component subtasks.

Skill/Knowledge Analysis

- The skills and knowledges required to support subtask and task performance were inferred by instructors and SMSs.

Adequacy of Guidance Documentation (AFM 50-2 and AFP 50-58)

- AFM 50-2 and AFP 50-58 were not widely distributed.

- Training development personnel suggested that AFP 50-58 procedures were too complex, required too much paperwork, were in conflict with ATC regulations and policies, were oriented primarily towards development of new courses, and were too oriented toward aircraft and equipment.
- Most of those interviewed indicated that the documents would be more useful if time and resources permitted accomplishment of required effort.

Documentation of Task Analyses

- Relatively few groups had any formal, systematic way of documenting their task analyses.

Verification Procedures

- Task analyses were verified as part of the course implementation process (if the course worked well, then task analyses had been properly done).

Assessment of Training Inadequacy/Excessiveness

- Training development personnel most often relied on field evaluation data for determining training deficiences and excesses, but none were completely satisfied with the validity of these data.
- Current procedures for internal reviews of course control documents, curriculum materials, resources, and test items were generally deemed adequate.
- Student-generated course critiques were viewed with suspicion and considered an inadequate index of training inadequacy and excessiveness.

Adequacy of Formal ISD Training

- The two ISD courses that the majority of task analysts complete (3AIR75100, Technical Instructor, and 3AIR75130-X, Instructional System Development) were considered inadequate by the majority of interviewees:
  - 3AIR75100 did not achieve sufficient depth.
  - 3AIR75130-X was too detailed, boring, and dry.

Quality of and Problems Associated with AF ISD Program

- Time and resource constraints impede successful implementation of the ISD model.
- The ISD model is too difficult to understand, too complex to implement, and requires too much paperwork.

Current Procedures Survey: Major Commands (MAJCOMS)

Approach to ISD

- ISD teams were generally comprised of SMSs, civilian training specialists, a military education/training officer, and an enlisted ISD technician.
- SMSs were primarily responsible for completing task analyses.

Task Analysis Methods

- TAC and SAC relied heavily on Mager's Criterion-Referenced Instruction (CRI) approach to task analysis.
- MAC utilized a four-step process:
  - List tasks.
  - Identify training requirements.
  - Develop criterion objectives and subobjectives or subtasks.
  - Identify teaching points based on supporting skills and knowledges.

Information Sources

- Training development personnel utilized multiple information sources to support task analysis efforts:
  - OSs.
  - Technical orders (T.O.s) and manuals.
  - Existing training materials.
  - SMS inputs.

Guidance Documentation

- Training development personnel used the following guidance documents:
  - CRI materials.
  - AFM 50-2.
  - AFP 50-58.
  - IPISD.
  - Locally developed materials.

Documentation of Task Analyses

- All MAJCOMs produced task analysis documentation detailing tasks, subtasks, and supporting skills and knowledges.

Validation of Task Analyses

- MAJCOMs relied upon SMSs or the local Standardization/ Evaluation Branch to review the task analyses for accuracy, completeness, and appropriateness.

- Field evaluation reports (FERs) were also used to verify task analyses.

Study Team Review of AFM 50-2 and AFP 50-58

AFM 50-2

A review of AFM 50-2 indicated that it contains some useful task analysis guidance but that a considerable degree of sophistication would be required to isolate and interpret it. The document appeared to be more useful for training managers than for training development personnel in that it provides a thorough overview of the ISD process. It describes what must be done, but does not provide detailed guidance regarding how things are to be done. In defense of AFM 50-2, it was noted that it was not intended to be a procedures manual.

AFP 50-58 (Volumes I and II)

The ISD model and task analysis procedures presented in AFP 50-58, Volumes I and II (Chapters 1, 2, 3, and 5), are logically consistent. The documents provide a good orientation to ISD and a good overview of the major steps that comprise the model. However, the orientation and overview of the task analysis process was considered to be only marginally adequate.

Each step in the task analysis process presented would result in the generation of information necessary to perform the succeeding step. In addition, the procedures set forth for each step are adequate to operate on the information or data generated in the preceeding step. The documents also provided explanations and examples that were adequate to permit an understanding of the task analysis process described. Finally, the relationship between intermediate and accountable end-item documents was generally clear.

Volumes I and II suffer considerably on the usability/readability dimension. An attempt is made to organize the concepts and procedures to facilitate understanding and application. However, many of the concepts are inherently difficult individually and certainly collectively. Comprehensiveness is often achieved at the expense of

clarity of presentation. Detailed descriptions of management concerns are often embedded within the task analysis guidance and tend to obscure, and sometimes overpower it. Main points are generally difficult to identify.

The writing style is, for the most part, straightforward and comprehensible. However, the heavy dependency on figures and tables results in extreme fragmentation of the text. For example, of the 88 pages that comprise Chapter 2 and 3, 70 pages contain figures and/or tables. Twenty-eight of these pages contain full-page figures or tables, and 42 contain half-page figures or tables. This fragmentation can discourage even the most interested reader. For that reason, the reading demands are considered excessive.

Flow diagrams are the primary mechanism for providing an integrated overview of and showing the interrelationships among the activities that comprise Step 1 and 2 of the ISD model. Additionally, flow diagrams are used to depict some of the more complex step-by-step procedures described. This type of figure requires a special type of literacy that most users would not possess. The figures and tables, while generally adequate in the sense that they contain useful information, do contribute substantially to the textual fragmentation problem mentioned previously.

In conclusion, there is some useful task analysis guidance in AFP 50-58, but a considerable degree of sophistication and experience would be required to isolate and interpret it. It would seem unreasonable to expect that a SME or group of SMEs could implement that task analysis process described. An individual with considerable backgound in ISD would have to translate the task analysis process described into a plan of action to cover a particular course design or redesign effort; and, further, would have to actively participate in the effort.

Study Team Review of AF ISD Training

Course 3AIR75100, Technical Instructor

The 16-hour ISD block of the 3AIR75100 course exhibited both strengths and weaknesses. The instructional intent was clearly conveyed, and the supporting objectives were appropriate. The level of difficulty was also deemed appropriate for the student population. Additionally, the practice exercises and format of the course materials were judged to be adequate. However, these strengths were attenuated somewhat by the deficiencies. Specifically, the study guide and corresponding sections of the workbook did not accurately portray the true nature of the ISD model. Important aspects of the model were omitted, and the interaction of the model's five steps was not well addressed.

Course 3AIR75130-X, Instructional System Development

The 3AIR75130-X course was deemed satisfactory with regard to clarity and appropriateness of instructional objectives, accuracy of information presented, and adequacy of instructional logic. However, the difficulty level of the course, along with the use of adjunctive programming techniques, may overwhelm all but the brightest and most highly motivated students.

CONCLUSIONS AND RECOMMENDATIONS

The survey findings revealed a multitude of general and specific problems with regard to ATC's task analysis and ISD efforts. These problems seemed to cluster in three areas; therefore, the conclusions and recommendations are organized and reported in three sections. The first section addresses the area of administration and management of the ATC task analysis and ISD efforts. The second section encompasses training of ATC personnel who participate in such efforts. The third section presents conclusions and recommendations that deal with the nature of documentary guidance currently available to ATC training development personnel.

Administration and Management

ATC Task Analysis Effort

There was considerable variation in the rigor with which the groups at various centers, and even branches within groups, accomplished and documented task analyses. In all cases, the amount of rigor achieved seemed directly proportional to management's commitment to and experience with ISD. This wide variation in commitment suggested the need for a better orientation to and improved training in the ISD process and task analysis procedures for all levels of management and supervision. This perceived need will be addressed at greater length in one of the recommendations that follows.

The task analysis procedures and documentation methods currently utilized at the centers were widely variant. Documentation produced in response to inquiries regarding how the results of task analyses were recorded ranged from Plans of Instruction (POIs) to fairly detailed ISD worksheets, most of which were locally designed. Under the circumstances that prevailed at the time of the survey, quality control of the task analysis effort across branches within the same group would have been difficult and an integrated quality control program across centers would have been virtually impossible. Therefore, an attempt to develop and implement a standardized task analysis procedure and documentation system for application at all centers seemed a worthwhile pursuit. Standardization was expected to permit initiation of a rigorous quality control program directed toward maximizing management's support of the task analysis effort. Increased management support might have the beneficial effect of improving the attitudes and motivation of training development personnel at the centers.

The issue of accountability was, of course, closely related to quality control. Once again, the survey showed that no individual or group of individuals was ultimately accountable for the task analysis within the present organization. For ATC to obtain the maximum benefits associated with implementing a standardized task analysis procedure and documentation system and to insure a rigorous quality control program, an articulated accountability system must be defined and implemented.

It was recommended that a standardized task analysis procedure and documentation system and improved procedures for in-process review of task analysis efforts be developed and field tested at ATC technical training centers. Further, it was suggested that ATC consider instituting both a task analysis quality control program and a formal accountability system.

The ATC ISD Effort

The most pervasive problem observed during the site visits to the TTCs was that attitudes toward ISD seemed less than optimal, particularly at the working level. In those few instances where positive attitudes were exhibited, they were generally a direct reflection of local command attitudes toward ISD or were based on the commitment and energy of one or two ISD advocates at the worker level. In reality, most training development personnel had little incentive for rigorously applying ISD principles in course design and redesign efforts. Supervision generally placed primary emphasis on compliance with ATC regulations, and the production and updating of course control documents that would satisfy inspection team criteria. Standard operating procedures seemed invariably to dictate "do things as they have always been done."

The fact that ATC chose to diffuse the center level ISD teams and to place more responsibility on the branches at the TTCs seemed to intensify the attitudinal problem. Perhaps even more important than aggravating an already grave attitudinal problem was the fact that ISD was to take place exclusively within the context of an operational training system. The reality seemed to be that day-to-day training operations took priority over ISD activities. The "old" centralized ISD teams were not always effective and efficient. However, the survey seems to show that whatever ineffectiveness and inefficiency occurred resulted primarily from problems associated with implementation of the centralized ISD team concept rather than any inherent weakness in the concept itself. There was evidence that a dedicated team of SMSs and instructional designers could accomplish ISD effectively and efficiently. Interestingly the MAJCOMS, the Navy, industry, and universities are successfully utilizing the team approach.

The other major problem noted during the site visits was lack of quality control and the absence of an accountability system for ISD efforts. Ultimately, the group commander was responsible for quality control of ISD activities within the organization and was directly accountable to ATC Headquarters. A commonly expressed theme was that

ISD is everyone's responsibility. However, unless all levels of management actively participated in monitoring ISD efforts, and certain individuals or organizational elements were held accountable for those efforts, the chances of fully obtaining the benefits associated with rigorous application of the ISD model would be minimal.

It was recommended that ATC create a task force to evaluate current ISD activities. It was suggested that particular emphasis be placed on projecting the training and cost benefits associated with rigorization of the ISD program using the dedicated team approach, and making recommendations regarding the nature of ATC's ISD effort in the 1980-1990 time frame. Futher, an in-depth investigation of ways to optimize the ISD process should be conducted. At a minimum, the investigation should address:

- o Identification of exemplary ISD programs which could serve as models.
- o Characterization of current ISD teams in terms of optimum size and skill mix.
- o Recommendations for optimizing team configuration for type of training (such as equipment versus nonequipment oriented) and training context (such as formal, correspondence).
- o Development of standards for selecting team members.
- o Definition of an integrated personnel acquisition and training program.
- o Definition of an integrated quality control program and a definitive accountability system.

Training

ISD and Task Analysis

There were strong indications that some major training problems existed. Taken together, the survey results and the cursory review of ISD courses suggested that current ISD and task analysis training were of questionable value for working level training development personnel. Survey comments provided little insight into the true nature of the problems. For example, comments heard most frequently were that the 3AIR75130-X course "contains too much information," "contains too little information," "contains too little detailed information," "is more appropriate for managers than for workers." As far as working level personnel were concerned, the courses were at once too detailed and too general. They were, however, unanimous in their opinion that the training would prove beneficial for others.

As previously noted, the course reviews indicated a number of serious deficiencies. Specifically, the 3AIR75100 course omitted important aspects of the ISD model and did not adequately address the interactional nature of the model's five steps. The 3AIR75130-X course was found deficient primarily as a result of the inappropriateness of the self-paced nature of the course and the use of adjunctive programming. These observations, coupled with the poor attitudes toward ISD and the lack of standardization and sometimes rigor in ISD and task analysis practices evidenced across and within centers, suggested the need for an in-depth evaluation of current ISD courses. Special attention should be directed to those portions of the courses that provide an orientation to the AF ISD model and indoctrination in ATC policy regarding application of the model. Those course sections devoted to task analysis also seemed to warrant critical examination.

ATC should be commended for recognizing the need to provide formal training in the ISD process and its associated procedures. Classroom training alone, however, is not sufficient to insure an efficient ISD program. A frequently recurring theme in discussions with training development personnel at the centers was that "the best way to learn ISD is by doing it." However, the survey showed a marked absence of any rigorous on-the-job training (OJT) program in the area of ISD. A well-structured OJT program would provide an appropriate vehicle for training development personnel to develop and refine their ISD skills.

It was recommended that ATC consider a third-party critical evaluation of current ISD training. At a minimum, the following courses should be examined: 3AIR75100, Technical Instructor Course (ISD Unit); 3AIR75130-X, Instructional Systems Development; 3AZR75133, Instructional System Designer; and 30ST7500-3, Development and Management of Instructional Systems. Additionally, the feasibility of modularizing the ISD courses for the purpose of achieving differential levels of depth within individual model steps and across the entire model should be investigated. If modularization proved feasible, a multiple track instructional system could be devised that would provide flexible ISD curricula tailored specifically to the needs of personnel, their supervisors, and middle and upper level managers. ATC should also consider developing or procuring a task analysis training course for immediate implementation.

Guidance Documentation

ISD and Task Analysis

During the survey, it was noted that currently available ISD and task analysis guidance documents (AFM 50-2 and AFP 50-58) were not widely utilized by the training development personnel at the centers. In fact, many groups had great difficulty locating a copy of either document. There is a need to examine the current dissemination policy and local distribution procedures to insure that current and anticipated documentary guidance is readily available to all intended users.

Frequently heard comments regarding these documents included, "too complex," "require too much paperwork," and "most applicable to the design of new courses." A review of these documents supports the excessive procedural complexity and paperwork comments. There seemed to be a legitimate need for a simplified task analysis procedure and documentation system that could be applied in both the development and revision of technical training courses. Additionally, a preliminary assessment of the feasibility of implementing an automated storage/retrieval system for task analysis data seemed warranted. It was felt that this type of data bank could constitute an important element in an accountability system and would certainly have the beneficial effect of improving institutional memory.

One final observation regarding the utilization of the information sources relevant to task analysis was made. Most groups interviewed seemed to be making less than optimal use of the full range of information potentially available to them, particularly the OS. Technological innovations at OMC, most notably the Current Task Inventory Bank, would help solve the frequently cited problem of "lack of currency." Additionally, the guidance documentation should emphasize the use of the OS in course revision efforts, and ISD training courses should be revised to insure that training development personnel are fully aware of the full range of OS reporting options currently available. Current dissemination policy and local distribution procedures deserved examination and revision if necessary to insure that all intended users have access to the OS and other pertinent information sources.

Based on the survey findings and observations, it was recommended that a simplified task analysis procedure and documentation system, including improved procedures for in-process review of task analysis efforts, be developed and field tested at ATC TTCs. Additionally, an investigation into the feasibility of providing an automated storage/retrieval system for task analysis data was recommended. The Air Force Human Resources Laboratory (AFHRL) and ATC directed the development of a prototype task analysis handbook. Further, ATC agreed to support field testing of the prototype handbook at the TTCs.

SECTION III

HANDBOOK DESIGN METHODOLOGY

DESIGN GOALS

The need for a standardized task analysis procedure and documentation system for use in AF technical training had been clearly established. Therefore, the primary design goals were: (a) to develop simple-to-use, reliable, valid, and time-efficient and cost-effective task analysis/documentation procedures; and (b) to provide a handbook that would facilitate implementation of those procedures by ATC training development personnel.

DESIGN PROCESS

Identification of Target Population

As a result of a reorganization within ATC, the responsibility for completing and documenting task analysis shifted from ISD specialists to SMSs. Survey interviews revealed that military instructors, in the intermediate enlisted grades, would be the primary users of the handbook.

Establishment of Handbook Design Goals and Approach

Five handbook design goals were formulated on the basis of a re-examination of information gathered in interviews and in-depth reviews of AFM 50-2 and AFP 50-58. They were as follows:

(1) Present a straightforward, integrated task analysis procedure.
(2) Assume a training standard or comprehensive task list as the point of departure for task analysis activities.
(3) Minimize the amount of instructional analysis required of task analysts.
(4) Simplify documentation requirements to the greatest extent possible.
(5) Make periodic reviews by other SMSs an integral part of the task analysis process.

The design approach selected can best be characterized as eclectic. It called for utilizing, to the maximum extent possible, existing technology insofar as it was compatible with the current AF ISD model.

Review of AFM 50-2 and AFP 50-58

The task analysis procedures presented in AFM 50-2 and AFP 50-58 (Volumes I and II) were examined for possible inclusion in the handbook. Useful guidelines and information were extracted and were incorporated into the handbook.

Review of AF ISD Training Course Materials

Air Force ISD training course materials were examined to determine if the study guides and workbooks contained procedures and guidelines that should be included in the prototype handbook. Specifically, materials from the following courses were examined: 3AZR75100, Technical Instructor; 3AIR75130-X, Instructional System Design; 3AZR75133, Instructional System Designer; and 3AIR75160, Instructional System Materials Development. Some useful procedures and guidelines from the 3AZR75133 and 3AIR75160 courses were identified for inclusion in the handbook.

Review of Army and Navy Task Analysis Procedures

In addition to the AF ISD manuals and training course materials, current Army and Navy task analysis guidance documents were also reviewed. The United States Army Training and Doctrine Command Circular 351-4 contained a documentation system which appeared to meet the design goal of simplicity and seemed capable of accommodating the full range of tasks that would be encountered in ATC resident technical training.

Review of CRI Procedures

Interviews with MAJCOM training development personnel indicated that SAC and TAC relied heavily on the CRI approach to task analysis. Their success with this approach for skill-oriented training led to the decision to incorporate some CRI-type analytic techniques in the handbook.

Preparation of Prototype Task Analysis Handbook

Following completion of review and information-gathering activities, the initial version of the task analysis handbook was prepared. In keeping with design goals and criteria, a best-mix of available task analysis methodologies was presented in a format and at a reading level suitable for ATC task analysts.

The prototype handbook contained 29 pages of text, 18 figures, and 14 tables divided into four major sections. The first section provided a general introduction to ISD and task analysis, and an overview of handbook procedures and guidelines. The second, third, and fourth sections were devoted to the development of preliminary criterion objectives (PCOs), the identification of subtasks, and the specification of supporting skills and knowledges, respectively. The iterative process by which the handbook was refined and eventually finalized is described in the sections that follow.

SECTION IV

FIELD TEST METHODOLOGY

GENERAL

The field test of the prototype task analysis handbook was conducted in two stages. Stage 1 consisted of preliminary tryouts, while Stage 2 was devoted to feasibility testing. The purposes of the preliminary tryouts and feasibility testing and the procedures used are described in the paragraphs that follow. The information generated during field testing was used in preparing the final version of the task analysis handbook.

PRELIMINARY TRYOUTS

Preliminary tryouts were accomplished to obtain information useful for revising the prototype handbook. The goal was to develop an empirical data base that could be used to identify required revisions and make the handbook as useful as possible. A potentially important by-product of the preliminary tryouts was a set of task analysis examples directly relevant to AF technical training.

Test Sites and Procedures

Keesler, Edwards, and Chanute AFBs were selected for preliminary tryout of the handbook. The courses and specialty areas utilized as test beds at each site were as follows:

Keesler AFB

- 3ABR30430, Radio Relay Equipment Repairman
- 3ABR73230, Personnel Specialist

Edwards AFB

- STS 316X0T, Missile Systems Analyst Specialist and Missile Systems Analyst Technician
- STS 431X1E, Jet Aircraft Maintenance Specialist and Jet Aircraft Technician (Over Two Engines)
- STS 462X0, Weapons Mechanic and Weapons Maintenance Technician

Chanute AFB

- 3ABR3163OT, Missile Systems Analyst Specialist
- 3ABR75133, Instructional System Designer

For each course, a duty area was selected, and a task performance item and a task knowledge item from that duty area were chosen for analysis. For each course at a site, two SMSs participated in the preliminary tryout: one served as an analyst, the other as a reviewer.

Analysts used the handbook procedures to analyze and document one task performance item and one task knowledge item. Task analysts were encouraged to ask questions, identify problems, and present suggestions for improving the procedure. If the analyst failed to understand an explanation, another wording or elaboration was given. Failures to understand an example were treated in the same way. The problems encountered, explanations and additional information provided, suggestions for improvement, typographical errors, and other kinds of difficulties that the analysts encountered, were recorded. Reviewers had two tasks during preliminary tryouts. Their primary task, of course, consisted of reviewing task analysis worksheets and documentation. A secondary function involved critically reviewing the handbook in an attempt to identify faulty wording, unclear passages, inadequate explanations, poor examples, improper sequencing, poor layout, typographical errors, and other difficulties. Additionally, general suggestions for improving the handbook and procedures described therein were solicited.

Additionally, each Technical Training Group (TTG) at each TTC designated a senior review team, consisting of an educational specialist and a senior SMS, to examine the handbook. The senior review teams completed a free-response questionnaire containing items related to the adequacy and practicality of the task analysis procedure/documentation system described in the handbook, and items related to appropriateness of style and format.

FEASIBILITY TESTING

The primary purpose of feasibility testing was to assess the recommended task analysis procedure along the following evaluative dimensions: simplicity/usability, reliability, validity and time-efficiency/cost-effectiveness. A secondary purpose was to gather additional information which could be used in revising the handbook.

Test Sites and Procedures

Lackland, Lowry, and Sheppard AFBs were used for feasibility testing (formal evaluation). The courses and specialty areas utilized as test beds at each site were as follows:

Lackland AFB

- 3ABR30630, Electronic Communications and Cryptographic Equipment Systems Repairman
- 3ALR73430A, Equal Opportunity and Treatment
- 3ABR81130, Security Specialist

Lowry AFB

- o 3ABR64530, Inventory Management Specialist
- o 3AIR75100, Technical Instructor

Sheppard AFB

- o 3ABR36131, Cable Splicing Installation and Maintenance Specialist
- o 3ABR51131A, Programming Specialist (Burroughs Systems)
- o 3ABR90330, Radiologic Specialist

For each of these courses, a duty area was selected, and a task performance item and a task knowledge item from that duty area were chosen for analysis. For each course at each test site, four SMSs, one senior SMS, and one training specialist participated in the feasibility testing. The pool of four SMSs was divided into two two-member task analysis teams. On each team, one SMS served as the analyst, the other as reviewer. The senior SMS and the training specialist served as a task analysis evaluation team.

Analysts utilized the handbook to analyze and document the task performance item and the task knowledge item. Those participants designated as reviewers participated in the analysis and documentation activities in the manner prescribed in the handbook. The amount of time required by each team to complete each major step in the analyses was recorded. Upon completing the analyses, each of the analysts and reviewers was asked to complete the Handbook Evaluation Survey. This survey solicited opinions regarding the task analysis procedures as well as format and style. At Lowry and Sheppard AFBs, analysts and reviewers also completed the Innovation Evaluation Survey, a multiple scale instrument which required comparative judgments about current task analysis procedures and handbook procedures. These instruments are more fully described in the next subsection, Data Collection Instruments.

Evaluators then reviewed the completed task and knowledge analyses. Each analysis was assessed using accuracy, completeness, and overall adequacy as criteria. The outcome of this assessment formed the basis for evaluating the utility of the handbook in the development of objectives, the preparation of tests, and the design of instruction. The evaluators also judged the degree of correspondence between the analyses produced by the two analysis teams. The instruments used to collect these data, the Task Analysis Evaluation and Correspondence Questionnaires, are described in the next subsection.

Additionally, each TTG at each TTC provided a senior review team, consisting of an educational specialist and a senior SMS, which examined the handbook, identified problems and made suggestions for improvement, and completed the Handbook Evaluation Survey.

Data Collection Instruments

The five major data collection instruments utilized in field testing the task analysis procedure and handbook were the:

- o Handbook Evaluation Survey.
- o Innovation Evaluation Survey.[1]
- o Task Analysis Evaluation Questionnaire.[1]
- o Task Analysis Correspondence Questionnaire.[1]
- o Time Accounting Form.

Descriptions of these instruments are provided in the paragraphs that follow.

The Handbook Evaluation Survey was administered to analysts, reviewers, and senior review teams. It consisted of 42 Likert-type items that solicited opinions regarding the task analysis procedures prescribed in the handbook, as well as handbook format and style (see Appendix A). Specifically, inquiries were made regarding:

- o Format
- o Writing style and organization
- o Adequacy of the supporting materials
- o Validity
- o Reliability, and
- o Time-efficiency and cost-effectiveness.

Additionally, three free-response items were included to allow respondents to indicate those handbook features they liked best and least and to raise important issues not directly addressed in the survey.

The Innovation Evaluation Survey was also administered to analysts, reviewers, and senior review teams. It consisted of four scales that required respondents to make several different, but related, judgments about current task analysis procedures and the procedures prescribed in the handbook (see Appendix A).

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[1] Prior to finialization of the task analysis handbook, Preliminary Performance Requirements (PPRs) were referred to as PCOs. Therefore, the term PCO was used in this field test questionnaire. Hereafter, only the term PPR will be used in the text.

- Scale 1: For each step in the handbook procedure, the respondent was asked to indicate if that step was necessary for a complete and accurate task analysis (Step necessary: yes/no).
- Scale 2: For each step in the handbook procedure, the respondent was asked to indicate the relative amount of time expended on that step under current task analysis procedures (Step currently performed: yes/no; if yes, relative amount of time spent: large/moderate/small).
- Scale 3: For each step in the handbook procedure performed as part of the current task analysis procedure, the respondent was asked to indicate if the handbook procedure would be more, equally, or less time consuming than the current procedure.
- Scale 4: For each step in the handbook procedure performed as part of the current task analysis procedure, the respondent was asked to indicate if the handbook procedure was better than, about the same as, or worse than the current task analysis procedure.

The Handbook Evaluation and Innovation Evaluation Survey data sets were utilized as primary information sources in evaluating the handbook and the proposed task analysis procedure. A subsequent subsection (Evaluative Criteria) details how these data were utilized in formally evaluating the handbook.

The Task Analysis Evaluation Questionnaire was administered to Task Analysis Evaluation Teams. It consisted of two item sets (see Appendix A). Item set 1 required Task Analysis Evaluation teams to make the following judgments about task performance and task knowledge analyses:

- Does the PPR accurately reflect the behavior described in the STS item?
- Is the subtask listing accurate in that it reflects the major steps that must be accomplished in performing the task?
- Is the subtask listing thorough and complete in that it reflects all of the major steps that must be accomplished in performing the task?
- Are all relevant supporting skills and knowledges identified?

Item set 2 required judgments regarding the overall quality of the analyses their accuracy and the utility of the task analysis documentation.

The Task Analysis Correspondence Questionnaire was also administered to Task Analysis Evaluation Teams. It consisted of items that required judgments regarding the degree of correspondence between task performance analyses and between task knowledge analyses (see Appendix A). Specifically, task analysis evaluation teams answered the following questions:

- Does the PPR of analysis #1 closely match the PPR of analysis #2?
- Is there a high degree of correspondence between the subtasks identified in analysis #1 and those identified in analysis #2?
- Do the supporting skills and knowledges identified in analysis #1 match, in all important respects, those identified in analysis #2?
- Are analyses #1 and #2 essentially identical in all major respects?

The Task Analysis Evaluation and Correspondence Questionnaire data sets were utilized as primary information sources in evaluating the handbook and the proposed task analysis procedure. The subsection which follows (Evaluative Criteria) details how these data were utilized in formally evaluating the handbook.

The Time Accounting Form contained blocks for recording time expended, by the analyst and by the reviewer, in each task analysis stage (see Appendix A). A form was completed for each task performance analysis and each task knowledge analysis accomplished as part of the feasibility test.

Evaluative Criteria

The simplicity and usability of the handbook procedures was assessed by examining analyst, reviewer, and senior review team opinions regarding the readability of the handbook, the clarity of the explanations offered, the adequacy of examples included, and the appropriateness of the terminology. These data were gathered with the Handbook Evaluation and Innovation Evaluation Surveys. Additionally, handbook readability was assessed in accordance with the procedures specified in MIL-M-38784A.

The validity of the handbook procedures was assessed by examining the opinions of the task analysis evaluation teams with regard to: the accuracy of each analysis; the completeness of each analysis; and the overall adequacy of each analysis as a basis for developing objectives, preparing tests, and designing instruction. An overall rating of the quality of each analysis was also solicited. These data were gathered with the Task Analysis Evaluation Questionnaire.

The reliability of the handbook procedures was assessed by examining the judged correspondence between task performance analyses and task knowledge analyses in each course and the consistency of correspondence across courses. The consistency with which the new procedures produced high quality results provided an additional index of reliability. These data were gathered with the Task Analysis Correspondence and Evaluation Questionnaires.

The time-efficiency/cost-effectiveness of handbook procedures was assessed by examining the time required to complete analyses using these procedures. These data were used to derive an estimate of the total time required to task analyze each of the feasibility test courses in its entirety. The handbook time-to-completion estimates were then compared to similar estimates for baseline courses task analyzed using current procedures.

SECTION V

FINDINGS

PRELIMINARY TRYOUTS

Objective and Results

The objective of the preliminary tryout phase of field testing was to gather information that could be utilized to refine the handbook prior to feasibility testing (i.e., formal evaluation). At each test site, those training development personnel who participated as members of task analysis and senior review teams generated a sizable number of suggestions for improving the handbook. There was a substantial overlap between the suggestions put forth by the two groups of participants at each test site. This close agreement presumably constituted consensual validation and provided sufficient justification for revising the handbook in accordance with the suggestions that were made. Not surprisingly, both the number of new and the number of major suggestions generated decreased steadily from site to site. Consequently, it was concluded that the preliminary tryouts had indeed served their primary purpose--a considerable amount of refinement had been accomplished.

Handbook Modifications

Handbook modifications made as a result of preliminary tryouts involved revisions to the procedures contained in the handbook and changes in the format and layout of the handbook. Major changes and revisions are described in the paragraphs that follow. Minor revisions included textual changes to clarify points that caused confusion or tended to be overlooked by the analysts, and to make certain sections more readable and understandable.

Modifications to Handbook Procedures and Guidelines

A major change was made in handbook procedures. In the initial version of the handbook, it was assumed that each STS/CTS item described a single task. It became apparent during preliminary tryouts that many STS/CTS items actually encompassed a number of related tasks. Procedures were revised to require analysts to examine each STS/CTS item to determine whether it was "singular" (encompassed only one task) or "global" (encompassed more than one task). Additionally, procedures for breaking global items into component tasks were included in the handbook.

Another problem encountered with the earliest version of the handbook concerned the preparation of the task performance and task knowledge lists. The handbook recommended preparation of separate lists. Several field test participants pointed out that the end result would be a somewhat random list of performances and knowledges. Therefore, a single form was devised to allow grouping, by duty area, of related task performances and task knowledges.

Additional guidelines for dealing with tasks that were primarily procedural in nature were also provided. The initial version of the handbook classified tasks as procedural and nonprocedural. It did not consider that class of tasks in which some subtasks have to be performed in a prescribed sequence, while others do not. In the revised version, analysts were directed to treat these types of tasks as procedural, and then define a fixed sequence for the nonprocedural components.

Procedures for analyzing tasks that are already accurately and completely defined elsewhere (e.g., in T.O.s) were altered. During the course of preliminary tryouts, analysts were copying task breakdown information from T.O.s. The revised version of the handbook directed analysts to reference the appropriate T.O. and proceed with the identification and documentation of supporting skills and knowledges.

An early version of the handbook called for completing subtask documentation prior to identifying supporting skills and knowledges. It quickly became apparent that this was inefficient. Supporting skills and knowledges were to be documented in a column beside the corresponding subtask. If a particular subtask had numerous supporting skills and knowledges, the space left for recording skills and knowledges was generally insufficient. The revised procedures directed the analyst to formally document each subtask and then its associated supporting skills and knowledges.

Modifications to Handbook Format and Layout

Experience with early versions of the handbook suggested that some changes in format and layout were desirable. The description of the purpose and scope of the handbook eventually became the lead paragraph in the introductory section. The placement of the figures and tables was also altered. Initially, all figures and tables were placed on foldout pages at the end of the handbook. Foldout pages were utilized to maintain textual continuity and to eliminate frequent page turning. Handbook users felt that the figures and tables relevant to a chapter should be placed at the end of that chapter, and that change was made.

FEASIBILITY TESTING

Characterization of Participants

Personnel who participated in the handbook feasibility test may be conveniently grouped into four major categories:

(1) Task analysts.

(2) Task analysis reviewers.

(3) Task analysis evaluation teams.

(4) Senior review teams.

Biographical information relevant to each participant group is summarized and discussed in the paragraphs that follow.

Pertinent information for those who participated as analysts during the feasibility test are summarized in Table B-1 of Appendix B. Fourteen of the 16 analysts were enlisted persons, with the majority holding the rank of Staff Sergeant or higher. The average number of years in the AF/Federal Government Service was 7.78. Most of the analysts were Instructors, and the average time in current position was 2.32 years. Years of field experience ranged from one to nine. In addition to the 75100 course (Technical Instructor), a majority of analysts had completed the 75130 in-service training course (Instructional System Design). These data indicate that those participants who served as analysts were typical of the target population for whom the handbook was intended - instructors with some classroom experience and minimal ISD training.

Pertinent biographical information for those who participated as reviewers during feasibility testing are summarized in Table B-2 of Appendix B. Thirteen of the 16 reviewers were enlisted persons, with the majority holding the rank of Staff Sergeant or higher. The average number of years in the AF/Federal Government Service was 10.66. Most of the reviewers were instructors, and the average time in current position was 1.77 years. Years of field experience ranged from zero to 20. In addition to the 75100 course, a majority of reviewers had completed the 75130 course. These data suggest that the reviewer and analyst populations did not differ in any major way and that those participants who served as reviewers were similar to the enlisted personnel who might be asked to participate as SMSs in future task analysis efforts.

Pertinent biographical information for those who participated as evaluators during feasibility testing are summarized in Table B-3 of Appendix B. Thirteen of the 17 evaluators were enlisted persons, with the majority holding the rank of Staff Sergeant or higher. The average number of years in the AF/Federal Government Service was 12.94. The majority of evaluators were instructors and instructor supervisors and the average time in current position was 1.38 years. Years of field experience ranged from two to eight. In addition to the 75100 course, a majority of reviewers had completed the 75130 course and a few had completed the 7500-3 course. More experienced evaluators with greater seniority would have been preferred, but in general, the evaluators were judged to be capable of assessing the adequacy of task analyses and the degree of correspondence between analyses.

Pertinent biographical information for those who participated as senior reviewers during feasibility testing are summarized in Table B-4 of Appendix B. Eight of the 17 senior reviewers were civilians, eight were enlisted persons, and one was an officer. The average number of years in the AF/Federal Government Service was 19. Most of the senior reviewers were training specialists or instructor supervisors, and the average time in current position was 4.39 years. It should be noted, however, that the value for average time in current position was inflated considerably by including two training specialists who had

held their positions for 29 and 18 years, respectively. If these outlying values are deleted, the average time in current position is 1.84 years. Years of field experience ranged from zero to 24. In addition to the 75100 course, a majority of the senior reviewers had completed the 75130 course and several had completed 7500 series courses. Those selected to participate as senior reviewers were well qualified to serve in that role.

Handbook Simplicity and Usability

The simplicity and usability of handbook procedures was assessed by examining the judgments of task analysts, reviewers and senior review teams with regard to:

- The handbook format.
- The writing style and organization of the handbook.
- The handbook procedures, with special emphasis on the inherent logic and consistency of the procedures.
- The adequacy of supporting materials.

These data, gathered with the Handbook Evaluation Survey, supported a direct assessment of the simplicity and usability of the handbook and the procedures contained therein. Additionally, a MIL-M-38784A readability analysis was conducted. Indirect assessment of simplicity and usability was obtained from the responses of task analysts and senior review teams to Scale 4 of the Innovation Evaluation Survey.

Direct Assessment: Handbook Evaluation Survey Data

All analysts, reviewers, and senior reviewers completed the Handbook Evaluation Survey. The data for those items that assessed the simplicity/usability of the handbook and the procedures contained therein are summarized in Appendix C, Table C-1. This data set was examined in several different ways; and the results of those analyses are summarized and discussed in the paragraphs that follow. Analyst and reviewer data were pooled, and the response patterns compared with those of senior reviewers. Additionally, analyst and reviewer response patterns were compared as a function of course orientation and experience level of participants.

Courses were characterized as equipment or nonequipment oriented. Equipment oriented courses were those that involved predominantly hands-on activities, specifically:

- 3ABR30630, Electronic Communications and Cryptographic Equipment Systems Repairman.

- o 3ABR36131, Cable Splicing Installation and Maintenance Specialist.

- o 3ABR90330, Radiologic Specialist.

Nonequipment oriented courses were those that dealt with primarily cognitive activities, specifically:

- o 3ALR73430A, Equal Opportunity and Treatment.

- o 3ABR81130, Security Specialist.

- o 3ABR64530, Inventory Management Specialist.

- o 3AIR75100, Technical Instructor.

- o 3ABR51131A Programming Specialist (Burroughs Systems).

Participant experience levels were defined on the basis of years of field experience. Median splits produced analyst and reviewer groups with the following profiles:

- o inexperienced analysts - 2.13 years field experience (range: 1 to 3 years)

- o experienced analysts - 7.38 years field experience (range: 6 to 9 years)

- o inexperienced reviewers - 2.13 years field experience (range: 0 to 4 years), and

- o experienced reviewers - 8.75 years field experience (range: 4.50 to 20 years).

Format - Item 14 of the Handbook Evaluation Survey dealt with the desirability of numbering handbook paragraphs. Handbook paragraphs were not numbered in the feasibility test version of the handbook. Analysts and reviewers were neither strongly in favor of, nor strongly opposed to, paragraph numbering (see Table C-1). Analysts from nonequipment oriented courses tended to be more negative regarding paragraph numbering than were analysts from equipment oriented courses. Senior reviewers reacted negatively to the idea of paragraph numbering. It was concluded that there was no need to number handbook paragraphs.

Item 22 sought opinions regarding the desirability of placing handbook examples, figures, and tables in a separate volume. Eighty-eight percent of the respondents indicated that a separate volume for supporting materials was undesirable (see Table C-1). Analysts were more strongly in favor of a single, integrated volume than were reviewers. The single volume preference was most striking for analysts from equipment oriented courses. In general, experienced respondents were more strongly in favor of a single volume than were inexperienced

respondents. Senior reviewers were very strongly in favor of having textual explanations and examples, tables, and figures in a single volume.

Approximately 44% of the respondents agreed that the examples, figures, and tables should be embedded in the text (see item 25, Table C-1). The patterns of responding for analysts and reviewers were highly similar. Partitioning by course type produced essentially identical response patterns. When the data were partitioned by experience level, some interesting differences surfaced. Inexperienced analysts and reviewers were strongly in favor of embedding the examples, tables, and figures in the text; while experienced respondents were not. Senior reviewers were strongly opposed to embedding supporting materials in the text.

Item 33 sought opinions regarding the length of the handbook. More than 70% of the respondents did not feel that the handbook was excessively long (see Table C-1). Analysts in equipment oriented courses and reviewers in nonequipment oriented courses most often responded that the handbook was of appropriate length. When the data were partitioned according to experience level, the experienced analysts and reviewers indicated that the handbook was of appropriate length more frequently than did their less experienced counterparts. The majority of senior reviewers (73%) indicated that the handbook was of appropriate length.

Response patterns on items related to handbook format indicated, for the most part, that respondents felt that the structure of the handbook was adequate. Changes that would appeal to specific subgroups were identified. However, it was believed that these types of changes might compromise the overall usefulness of the handbook.

Writing Style and Organization - A substantial majority of the analysts and reviewers felt that the writing was comprehensible (see item 30, Table C-1). Analyst and reviewer response patterns were essentially identical. Partitioning on the basis of type of course and experience level produced no noteworthy differences. The response pattern of senior reviewers matched that obtained for analysts and reviewers.

Handbook readability was assessed in accordance with MIL-M-38784A procedures. The overall grade level was equal to 10.97, with the readability of the samples ranging from 10.34 to 12.6. Opinions were also sought regarding the readability of the handbook (see item 38, Table C-1). A majority of the analysts and reviewers indicated that the handbook was readable. The response patterns of analysts and reviewers were essentially identical, with reviewers unanimously agreeing that the handbook was readable. There were no marked differences in response patterns as a function of course type and experience level. A majority of senior reviewers (75%) also indicated that the handbook was readable.

Response patterns to a third item related to reading demands, Item 31, indicated that a large majority of respondents (85%) felt that handbook reading demands were appropriate (see Table C-1). No reliable

differences were found between analysts and reviewers, and there were no differences as a function of type of course or level of experience. Those few individuals who indicated that reading demands were inappropriate were inexperienced analysts and reviewers. Senior review teams were not as positive regarding the appropriateness of reading demands as were analysts and reviewers.

Item 35 of the Handbook Evaluation Survey sought opinions regarding handbook terminology. A substantial number of analysts and reviewers indicated that the terminology was clear and unambiguous (see Table C-1). Analyst and reviewer response patterns did not differ. Analysts and reviewers from nonequipment oriented courses indicated greater difficulty with the terminology than did their counterparts from equipment oriented courses. Response patterns did not differ as a function of experience level. Senior review teams were evenly divided on the issue of the clarity of handbook terminology.

Two Handbook Evaluation Survey items addressed the clarity with which handbook procedures are presented. The response patterns for Item 36 indicated that approximately 70% of the respondents felt that handbook concepts are clearly presented (see Table C-1). Analyst and reviewer response patterns were essentially identical. When the data were partitioned on the basis of course type and experience level, differences in response patterns were negligible. Fifty percent of the senior reviewers indicated that handbook concepts are clearly presented.

A majority of respondents (66%) indicated that main points were easily identified (see Item 24, Table C-1). Again, no significant differences in analyst and reviewer response patterns emerged, and differences in response patterns as a function of course type and experience level were negligible. Seventy-five percent of the senior reviewers indicated that main points were easy to identify.

To summarize briefly, response patterns on items related to handbook writing style and organization indicated that respondents felt that the writing was comprehensible and readable, the reading demands appropriate, and the terminology clear and unambiguous. An independent readability analysis yielded an overall reading grade level of 10.97. Additionally, a majority of respondents indicated the handbook concepts were clearly presented and that main points were easily identified.

Consistency, Logic, and Documentation Requirements - The internal consistency of the handbook task analysis procedure was assessed with two items. Item 18 was directed at assessing whether or not sufficient explanation was given for each step to permit understanding of the task analysis procedure (see Table C-1). Once again, the differences between analyst and reviewer response patterns were small. Respondents from nonequipment oriented courses were approximately twice as likely to report difficulties as were respondents from equipment oriented courses. No dramatic differences surfaced as a result of experience level partitioning. Eight of the 12 senior reviewers agreed that sufficient explanation was provided.

Item 34 also concerned the task analysis procedures, but was more general in nature than Item 18. Again, approximately 70% of the analysts and reviewers agreed that the procedures were organized in such a manner that they were easy to understand and apply (see Table C-1). No differences between the analyst and reviewer response patterns surfaced. Differences obtained for equipment versus nonequipment oriented courses were not striking, nor were those obtained as a function of experience level. A majority of the senior reviewers agreed that the procedures were organized in such a way that they are easy to understand and apply.

Six Handbook Evaluation Survey items were related to the inherent logic of the task analysis procedure prescribed in the handbook. Item 39 sought respondent opinions regarding the appropriateness of converting STS/CTS items into behavioral statements. Approximately 75% of the analysts and reviewers agreed that the conversion of STS/CTS items to behavioral statements was appropriate (see Table C-1). There was no real difference in the response patterns of analysts and reviewers. Analysts from equipment oriented courses were more positive regarding the conversion than were analysts from nonequipment oriented courses, indicating that conversions may be more difficult in nonequipment oriented courses. When the data were partitioned according to experience level, no dominant response patterns emerged. More than 90% of the senior reviewers agreed that the conversion was appropriate.

Item 17 required respondents to indicate agreement or disagreement with the statement "The handbook should contain a short explanation of how STSs and CTSs are developed." Analyst, reviewer, and combined analyst and reviewer response patterns were essentially identical, with approximately 50% agreeing that a short explanation should be provided (see Table C-1). In each case, a slightly smaller proportion disagreed, with no marked differences as a function of course type or experience level. Sixty-four percent of the senior reviewers agreed that the handbook should contain a short explanation of how STSs and CTSs are developed.

The response patterns on Item 27 indicate that an overwhelming proportion of respondents felt that each step in the handbook task analysis procedure leads logically to the next step. Two-thirds of the senior reviewers were also in agreement (see Table C-1).

Seventy-five percent of the analysts and 69% of the reviewers, respectively, agreed that each step in the task analysis procedure would lead to the generation of the information necessary to perform the next step (see Item 21, Table C-1). There were no differences in response patterns as a function of course type or experience level. Sixty-seven percent of the senior reviewers agreed that each step in the procedure would generate the information necessary to perform the next step.

Eighty percent, 67%, and 58% of the analysts, reviewers, and senior reviewers, respectively, agreed that the procedures for each step in the task analysis sequence are adequate to operate on the

information generated in the preceding step (see Item 15, Table C-1). Partitioning analyst and reviewer data by course type and by experience level produced some small, but uninterpretable, response pattern differences.

A majority of the analysts and reviewers (56%) reported that the procedure was sufficiently flexible (see Item 5, Table C-1). There were no differences between the response patterns of analysts and reviewers. When the data were partitioned by type of course, no real differences were obtained, although reviewers from nonequipment oriented courses were less positive than the other respondent groups. When the data were partitioned according to experience level, inexperienced analysts and reviewers indicated that the procedure was sufficiently flexible more often than experienced analysts and reviewers. A majority of senior reviewers (73%) indicated that the procedure was sufficiently flexible.

We also sought opinions regarding documentation requirements. Fifty-six percent of the analysts and reviewers agreed that task diagrams were necessary (see Item 41, Table C-1). Interestingly, analysts favored task diagramming more strongly than reviewers. Analysts and reviewers from equipment oriented courses were favorably disposed toward the diagrams, as were analysts from nonequipment oriented courses. Reviewers from nonequipment oriented courses, however, questioned the need for task diagrams. Inexperienced reviewers and senior review teams were also unconvinced of the necessity for task diagramming. Most importantly, however, those charged with doing and documenting the analyses seemed convinced of the necessity of preparing task diagrams.

A related item (number 19) called for respondent opinions regarding documentation requirements. Approximately half the analysts and reviewers did not feel that documentation requirements were excessive (see Table C-1). Again, analysts were less likely than reviewers to think that the documentation requirements were excessive. There was little difference in response patterns for analysts and reviewers from equipment and nonequipment oriented courses. Inexperienced analysts indicated that documentation requirements were reasonable with greater frequency than experienced analysts. While the response patterns for experienced and inexperienced reviewers were essentially identical, senior reviewers indicated that documentation requirements were excessive.

In summary, most respondents agreed that the handbook contained sufficient information and was organized in such a way that it was easy to understand and apply the task analysis procedure. The respondent sample was almost evenly divided on the issue of modifying the handbook to include a short explanation of how STSs and CTSs are developed. A majority of respondents agreed that each step in the procedure lead logically to, and would allow generation of, the information needed to perform the next step. Analysts, reviewers, and senior reviewers indicated that the guidelines for each step in the handbook procedure are adequate to operate on the information generated in the preceding

step. Opinions regarding documentation requirements were mixed. Analysts, particularly inexperienced analysts, favored task diagramming and indicated that handbook documentation requirements were reasonable. Experienced personnel, particularly those who simply reviewed the handbook, tended to express negative opinions. Perhaps the handbook procedures require a degree of rigor over and above that required by current procedures. Or it may be that the advantages of the proposed documentation only become apparent through use.

Adequacy of Supporting Materials - Five Handbook Evaluation Survey items were used to elicit respondent opinions regarding the adequacy of supporting material. These items were mainly directed at determining if explanations, tables, figures, and examples facilitated the use of handbook procedures.

The overall response pattern for Item 28 indicates that the analysts and reviewers felt that the figures and tables contained useful information. No differences between the response patterns of analysts and reviewers emerged. Partitioning on the basis of course type and experience level produced no noteworthy differences. A majority of senior reviewers agreed that the figures and tables contained useful information (see Table C-1).

Item 16 assessed the adequacy of the explanations offered for the steps of the handbook procedures. A majority of the analysts and reviewers (66%) indicated that the explanations were adequate (see Table C-1). There were no differences between the response patterns of analysts and reviewers. When response patterns were examined as a function of type of course or as a function of experience level, no significant differences surfaced. Sixty-seven percent of the senior reviewers agreed that explanations were sufficiently comprehensive to permit use of the handbook procedures.

Three items were used to determine if the examples given in the handbook were adequate. Item 42 was directed at determining if the handbook contained an adequate number and range of examples. Approximately half the analysts and reviewers agreed that the number and range of examples were adequate (see Table C-1). Analysts were less likely to agree than were reviewers. When the data were examined as a function of type of course, analysts from nonequipment oriented courses indicated that the range and number of examples was adequate more frequently than did those from equipment oriented courses. Reviewers from nonequipment oriented courses were also slightly more positive than reviewers from equipment oriented courses. When the data were partitioned according to experience level, inexperienced analysts were slightly more positive than experienced analysts. However, experienced reviewers were much more likely to respond positively than were inexperienced reviewers. Fifty-eight percent of the senior reviewers felt that the handbook provided an adequate number and range of examples.

Respondents were asked to indicate if the handbook examples provided adequate support for the textual material (see Item 13, Table C-1). More than half of the analysts and reviewers indicated that the examples were sufficiently supportive of the textual explanations. An examination of the analyst and reviewer data suggested that analysts were, on the whole, more positive in their opinions than were reviewers. When the data were examined as a function of type of course, analysts from nonequipment oriented courses were more positive than analysts from equipment oriented courses; while the opposite was true for reviewers. There were no noticeable differences when the data were examined as a function of experience level, except that the inexperienced analysts, the target population, most strongly agreed that the range and number of examples was sufficient. Sixty-seven percent of the senior reviewers indicated that handbook examples provided adequate support for textual materials.

Seventy-eight percent, 75%, and 75% of the analysts, reviewers, and senior reviewers, respectively, reported that the examples provided were realistic and meaningful (see Item 32, Table C-1). There was no reliable difference between the overall patterns of responding for analysts and reviewers, nor were there marked differences in response patterns as a function of type of course. When the data were partitioned on the basis of experience level, however, experienced analysts and reviewers were more positive than inexperienced analysts and reviewers. The majority of senior reviewers (75%) agreed that the examples provided were realistic and meaningful.

Findings related to the adequacy of supporting materials may be summarized as follows. First, analysts were more favorably disposed toward handbook examples than were reviewers or senior reviewers. Second, a substantial number of analysts and reviewers found that the examples provided adequate support for the text and were both realistic and meaningful. Third, and lastly, respondents seemed to be indicating that a larger number and range of examples would be desirable.

Indirect Assessment: Innovation Evaluation Survey Data

Scale 2 of the Innovation Evaluation Survey required respondents familiar with the handbook to indicate the relative amount of time expended, under current procedures, on each step of the proposed procedures. These time expenditure data are summarized and discussed in a subsequent section of this report. Scale 4 of the Innovation Evaluation Survey required respondents familiar with the handbook to evaluate comparable steps of the proposed and current procedures. Respondents were asked to indicate which steps in the proposed procedure were better than, about the same as, or worse than current procedures. These data are summarized in Table C-2. It should be noted that there is considerable fluctuation in the number of respondents across steps. The only judgments examined were those of respondents who indicated, in completing Scale 2, that time was spent under current procedures, on the step in question. Examination of these data indicates that handbook procedures are perceived to be:

- o Better than current procedures for the following steps: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, and 20.

- o As good as current procedures for the following steps: 1, 2, 9, 16, and 17.

In the opinion of this respondent sample, handbook procedures represent a considerable improvement over current procedures.

Validity

The validity of handbook procedures was assessed by examining the judgments of task analysis evaluation teams with regard to:

- o the accuracy of task analyses at the PPR, subtask, and skill/knowledge levels,

- o the overall accuracy, completeness, and quality of the analyses,

- o the utility of the resultant documentation for designing and validating training programs.

These data, gathered with the Task Analysis Evaluation Questionnaire, constituted a direct assessment of the validity of the proposed procedures.

Indirect assessments of the validity of handbook procedures were based on the responses of the task analysis and senior review teams to selected items and scales from the Handbook Evaluation and Innovation Evaluation Surveys. Pertinent Handbook Evaluation items dealt with the degree of analytic accuracy that could be anticipated if handbook procedures were employed and the perceived utility of the resultant documentation. The pertinent Innovation Evaluation Survey scale called for judgments regarding the necessity of each step in the proposed procedure.

Direct Assessment: Task Analysis Evaluation Questionnaire Data

Task analysis evaluation team judgments regarding the accuracy of task analyses at the PPR, subtask, and skill and knowledge levels are summarized in Appendix D, Table D-1. The evaluation teams indicated that the PPRs prepared by the analysis teams accurately reflected the behaviors called for in the STS/CTS items in 75% of the cases. Subtasks, and skills and knowledges listings were judged to be accurate and complete in 46% (mean of the accuracy and completeness component means) and 47% of the cases, respectively. There were no marked differences in accuracy patterns as a function of type of analysis, i.e., task performance (TP) versus task knowledge (TK), although the judged accuracy of skills and knowledges listings for task knowledge analyses was somewhat low. When comparisons were made as a function of course type, i.e., equipment oriented versus nonequipment oriented, no major differences in response patterns emerged, although subtasks for equipment oriented

courses were more accurately identified than subtasks for nonequipment oriented courses. These data indicate that acceptable levels of task analytic accuracy can be achieved utilizing handbook procedures.

Judgmental data regarding the overall accuracy and completeness of the task analyses are summarized in Table D-2. The overall accuracy and completeness results were entirely consistent with the PPR, subtask, and skills/knowledges results previously presented. In 44% of the cases, evaluators agreed that the analyses were accurate and complete. There were no marked differences in judged accuracy or completeness of analyses as a function of type of analysis or type of course (see Tables D-3 and D-4).

Overall quality ratings are summarized in Table D-5. It should be noted that 78% of the 32 analyses performed were considered to be of satisfactory quality, i.e., only 22% of the analyses received the "poor" rating. Approximately one-third of the analyses were rated "very good" or "excellent." There were no marked differences in judged quality of analyses as a function of type of analysis or type of course (see Tables D-6 and D-7). These quality data, in conjunction with the accuracy and completeness data, lend additional support to the conclusion that acceptable levels of analytic accuracy can be achieved with handbook procedures.

Data related to the judged utility of the task analysis documentation produced during feasibility testing are summarized in Table D-8. The majority of evaluators agreed that the documentation would facilitate the development of objectives, test items, and Parts I and II of the POI. Ninety-one percent of the evaluators agreed that the task analysis documentation would facilitate interpretation of FERs and would provide a good mechanism for insuring that only "need to know" information is included in a course. More importantly, 54% of the respondents agreed that the documentation would adequately support the development of objectives and test items by an SMS other than the one who had completed the analysis. There were no marked differences in judged utility of documentation as a function of type of analysis, TP versus TK (see Table D-9). Additionally, there were no marked differences in judged utility of documentation as a function of course type, equipment oriented versus nonequipment oriented (see Table D-10); although a greater percentage of respondents favored the equipment oriented documentation (83% versus 61%). These data, in conjunction with the data cited and discussed previously, adequately attest to the validity of the handbook procedures.

Indirect Assessment: Handbook Evaluation Survey Data

Five Handbook Evaluation Survey items bore directly on the issue of the validity of handbook procedures, and the pertinent data are summarized in Table D-11. Approximately 90% of the analysts and reviewers agreed that the documentation generated in applying handbook procedures

would be useful in developing learning objectives. No differences in analyst and reviewer response patterns surfaced. There were no marked differences in analyst and reviewer response patterns as a function of type of course or level of experience. The response pattern for the senior reviewers was essentially identical to that of the analysts and reviewers.

Thirty-seven percent and 50% of the analysts and reviewers, respectively, agreed that the task analysis documentation produced in applying procedures would be useful in preparing written tests and performance checklists. There were no marked differences in analyst and reviewer response patterns as a function of type of course. Experienced analysts and reviewers agreed that the documentation produced would be useful in test and checklist development with greater frequency than did inexperienced analysts and reviewers. Finally, senior reviewers tended to be more positive with regard to the utility of documentation than were their analyst and reviewer counterparts.

More than half of the analysts and reviewers (67% and 63%, respectively) agreed that the documentation produced in applying handbook procedures would be useful in interpreting and acting upon FERs. When the data were examined as a function of type of course, analysts and reviewers from equipment oriented courses expressed stronger positive opinions than those from nonequipment oriented courses. Response patterns did not differ as a function of experience level, except that experienced analysts tended to be more positive than inexperienced analysts. Fifty-eight percent of the senior reviewers agreed that the task analysis documentation produced would facilitate interpretation of FERs.

Forty-four percent and 54% of the analysts and reviewers, respectively, agreed that the use of handbook procedures would result in a complete and thorough task analysis. It is important to note that thirty-one percent of the analysts and 33% of the reviewers were undecided. Only 19% of the respondents disagreed with the statement that use of handbook procedures would result in a complete and thorough task analysis. There were no marked differences in response patterns as a function of type of course, although analysts in nonequipment oriented courses were less positive than those in equipment oriented courses. No marked differences emerged when the data were partitioned according to level of experience. Fifty-eight percent of the senior reviewers agreed that the use of handbook procedures would result in complete and thorough task analyses.

Seventy-five percent, 60%, and 75% of the analysts, reviewers, and senior reviewers, respectively, agreed that the use of handbook procedures would result in an accurate task analysis. There were no marked differences in analyst and reviewer response patterns as a function of course type or experience level.

Response patterns on Handbook Evaluation Survey items related to the validity of handbook procedures indicated that analysts, reviewers, and senior reviewers felt that:

- o Utilization of handbook procedures would result in complete, thorough, and accurate task analyses.

- o The documentation generated in applying handbook procedures would be useful in developing learning objectives, preparing written tests and performance checklists, and interpreting and acting upon FERs.

These results further attest to the validity of handbook procedures.

Indirect Assessment: Innovation Evaluation Survey Data

Scale 1 of the Innovation Evaluation Survey required respondents familiar with handbook procedures (i.e., analysts, reviewers, and senior reviewers) to indicate which steps in the handbook procedure were necessary for a complete and accurate task analysis. Those data are summarized in Table D-12. All 20 steps were considered necessary by a majority of respondents, with the proportions of positive responses ranging from .74 to .93. These data provide additional indirect evidence that handbook procedures are valid.

Reliability

The reliability of the handbook procedures was assessed by examining the judgments of task analysis evaluation teams with regard to

- o The correspondence between task analyses at the PPR, subtask, and skill/knowledge levels.

- o The overall correspondence between analyses.

These data, gathered with the Task Analysis Correspondence Questionnaire, constitute a direct assessment of the reliability of the proposed procedures. A second direct reliability assessment was achieved by examining the analysis quality and documentation utility data obtained using the Task Analysis Evaluation Questionnaire.

An indirect assessment of the reliability of handbook procedures was based on task analysis and senior review team responses to selected items from the Handbook Evaluation Survey. One of these items required respondent judgments regarding expected correspondence between analyses if two analysts, equal in subject matter expertise and working independently, utilized handbook procedures. The other required judgments regarding the consistency with which high quality results would be achieved if handbook procedures were applied across all types of courses.

Direct Assessment: Task Analysis Correspondence Questionnaire Data

Task analysis evaluation team judgments regarding the correspondence between task analyses are summarized in Appendix E, Table E-1. Matches at the PPR, subtask, and skill/knowledge levels were achieved in

63%, 32%, and 25% of the cases, respectively. Overall correspondence was achieved in 31% of the cases. These degrees of correspondence are modest. Some evaluators apparently adopted a stringent matching criterion which required one-to-one correspondence in wording. When the correspondence data were re-examined using a more lenient matching criterion (matching at the meaning, rather than word, level), matches at the PPR, subtask, and skill/knowledge levels were achieved in 75%, 38%, and 25% of the cases, respectively (see Table E-2). These new values do not, of course, represent significant increases in judged correspondence. Judged correspondence at the PPR, subtask, and skill/ knowledge levels did not differ markedly as a function of type of analysis (TP versus TK). It is interesting to note that matching at the subtask and skill/knowledge levels was better for nonequipment than equipment oriented courses under both scoring systems (stringent and lenient). Taken together, these data indicate that handbook procedures are modestly reliable, in terms of one of the definitions of reliability utilized in this research.

Direct Assessment: Task Analysis Evaluation Questionnaire Data

Data discussed in the previous section (Validity) indicated that application of handbook procedures consistently resulted in satisfactory analyses and useful documentation. This type of consistency seems to be as valid an indicator of the reliability of the procedures as is the degree of correspondence between analyses independently performed. These consistency data, along with the correspondence data previously presented, indicate that handbook procedures are sufficiently reliable for use in instructional design activities.

Indirect Assessment: Handbook Evaluation Survey Data

Two Handbook Evaluation Survey items bore directly on the issue of the reliability of handbook procedures, and the pertinent data are summarized in Table E-3 (see Items 12 and 10). Approximately 37% of the analysts and reviewers agreed that "two analysts, equal in subject matter expertise, utilizing handbook procedures and working independently, would produce essentially identical results," while 35% disagreed. Analysts from equipment oriented courses were much more likely to agree that two analysts would produce equivalent results than were analysts from nonequipment oriented courses (66% and 20%, respectively). A similar, but attenuated, pattern was obtained for reviewers from equipment and nonequipment oriented courses. When the data were partitioned by experience level, there were few differences between the experienced analysts and reviewers. Inexperienced reviewers, however, agreed more frequently than did inexperienced analysts. Fifty percent of the senior reviewers indicated that two analysts, working independently, would produce essentially the same results.

A second Handbook Evaluation Survey item was designed to elicit opinions regarding the statement "standardized application of handbook procedures across all types of courses would produce high quality results consistently." Fifty-four percent of the reviewers agreed,

whereas only 25% of the analysts agreed. It is important to note that 44% and 20% of the analysts and reviewers, respectively, were undecided, indicating a relatively small percentage of truly negative opinions. Response patterns for analysts and reviewers as a function of course type were not dramatically different, although reviewers affiliated with nonequipment oriented courses tended to be more positive than did the other subgroups. Inexperienced reviewers tended to be more positive than did their experienced counterparts. Forty-one percent of the senior reviewers agreed with the statement, 34% disagreed.

The response patterns for these two items are particularly difficult to interpret. The relatively high proportion of "undecided" responses suggests that respondents may have been confused by the wording of the questions. For instance, the term "essentially identical results" (see Item 12) can be interpreted in any number of ways ranging from one-to-one correspondence in wording to functional equivalence. Although the latter interpretation is more in keeping with the intent of the question, the correspondence data indicated that it was not unusual for task analysis evaluators to look for word-to-word matches. Handbook Evaluation Survey respondents may have ignored the modifier "essentially" and keyed on the modifier "identical." Unfortunately, item 10 contained an ambiguous modifier, "high," subject to a wide range of interpretations. Additionally, it is entirely possible that both of these items required respondents to speculate beyond their experiential frame of reference. Together, the ambiguity in the wording of items and the requirement to speculate without an appropriate frame of reference may account for the puzzling response patterns that surfaced.

Time-Efficiency/Cost-Effectiveness

The time-efficiency/cost-effectiveness of the proposed procedure was assessed by comparing the time required to complete task analyses during feasibility testing with the time required to complete task analyses using current procedures. Time expenditure data for current task analysis procedures were gathered from personnel who were involved, during calendar year 1978, in the revision of resident technical training courses (hereafter referred to as baseline courses). It should be noted that time expenditure data were collected at the STS/CTS item level during feasibility testing, while data for baseline courses were historical and generally recorded at the block level. A common index, task analysis hours per POI hour, was defined to compare handbook and current procedures in terms of time expenditure requirements. This comparative evaluation permitted a direct assessment of the time-efficiency/cost-effectiveness of handbook procedures.

Indirect assessments of the time-efficiency/cost-effectiveness of handbook procedures were based on the responses of task analysis and senior review teams to selected Innovation Evaluation Survey scales and Handbook Evaluation Survey items. The Innovation Evaluation Survey data of interest included:

- o respondent indications of the amount of time expended, under current procedures, on each step of the proposed procedure; and

- o respondent judgments regarding those steps currently performed for which the proposed procedures would be more, equally, or less time consuming than current procedures.

The Handbook Evaluation Survey data relevant to the time-efficiency/cost-effectiveness issue were the item groups that dealt with training development personnel skill qualifications, manpower issues, and implementation issues.

Direct Assessment: Time Expenditure Data for Current and Proposed Procedures

Task analysis time expenditure data are summarized in Appendix F, Table F-1. These data indicate very little overlap in the task analysis hours/POI hour distributions for the two data sets, with handbook procedures considerably less time consuming than current procedures. It should be noted that the STS/CTS items analyzed during feasibility testing were, for the most part, selected by the task analysis teams themselves. Collectively, the items were most likely among the least complex in the training standards and those with which the analysts and reviewers were most familiar. This certainly reduced the amount of time expended on task analysis activities during feasibility testing. It is difficult to believe, however, that these factors are solely responsible for the good showing made by handbook procedures. These data indicate that handbook procedures are more time-efficient and, therefore, more cost-effective than current procedures.

Indirect Assessment: Innovation Evaluation Survey Data

Scale 2 of the Innovation Evaluation Survey required respondents familiar with handbook procedures (i.e., analysts, reviewers, and senior reviewers) to indicate the relative amount of time expended under current procedures on each step of the proposed procedure. These data are summarized in Table F-2. It should be noted that only 14 of the 27 respondents who completed Scale 1 (Step Necessary?) also completed Scale 2. In several instances, respondents indicated that they had had no previous experience in task analysis and, therefore, could not complete Scale 2.

Time expenditure data were examined to identify those steps in the proposed procedure on which:

- o A considerable amount of time is expended under current procedures (a majority of the responses were "large" and "moderate"), and

- o A lesser amount of time is expended under current procedures (a majority of the responses were "small" and "none").

The results were as follows.

Steps in the proposed procedure to which considerable time is devoted under the current procedures are: 2, 3, 5, 6, 7, 8, 9, 10, 16, 17, and 20. Steps in the proposed procedure to which lesser amounts of time are currently devoted are: 1, 4, 11, 12, 13, 14, 15, 18, and 19.

In view of the fact that not all STS/CTS contain global items (Step 1), it is not surprising that a majority of respondents indicated that little or no time was spent breaking up STS/CTS items. The response patterns for Steps 4, 13, and 18 deal with the review of behavioral statements, subtasks, and supporting skills and knowledges, respectively. Evidently, minimal amounts of time are expended on review or quality control activities under current procedures, in spite of the fact that a majority of respondents felt that periodic reviews were necessary to insure thorough and accurate task analyses (see Section 4.2.3, Validity). The fact that minimal time is spent on review activities under current procedures would account for why so little time is currently spent revising subtask and supporting skills and knowledge listings (Steps 14 and 19).

The response pattern for Step 10 indicates that less time than would be expected is currently spent determining the types of tasks reflected in PPRs. Consequently, little time is expended in selection of appropriate analysis techniques (Step 11).

At first glance, the response patterns for Steps 12 and 15 are puzzling. All indications are that a great deal of time is currently expended identifying and analyzing subtasks. A closer examination of Step 12 led to the conclusion that respondents were indicating that little time is spent preparing task diagrams. Step 15, Analyze Subtasks, is given step status in the proposed procedure. In reality, it is comprised of two major activities - identify supporting skills (Step 16) and identify supporting knowledges (Step 17). Indications are that considerable amounts of time are expended on these activities within the framework of current procedures.

Scale 3 of the Innovation Evaluation Survey required respondents familiar with the handbook to indicate, for those steps of the proposed procedure that are performed as part of the current procedure, if the proposed procedure would be more, equally, or less time consuming. These data are summarized in Table F-3. It should be noted that there is considerable fluctuation in the number of respondents across steps. The only judgments included in this data set were those of respondents who had previously indicated that some time was spent on the step in question under current procedures.

Examination of these data indicates that handbook procedures would be

- Less time consuming than current procedures for the following Steps: 5, 6, 7, 8, 9, 13, 14, 18, and 20.

- o As equally time consuming as current procedures for the following Steps: 1, 2, 3, 4, 10, 11, 15, 16, 17, and 19.

- o More time consuming than current procedures for Step 12, Identify Subtasks (Task Diagrams).

In the opinion of this respondent sample, handbook procedures represent a considerable improvement over current procedures in terms of time expenditure requirements.

Indirect Assessment: Handbook Evaluation Survey Data

Ten Handbook Evaluation Survey items were related to the issue of the time-efficiency/cost-effectiveness of handbook procedures. Two items (3 and 8) were directed at eliciting information concerning user skill requirements; four items (40, 37, 29, and 26) were concerned with manpower issues, and four items (20, 23, 7 and 11) were concerned with the implementation of the handbook within ATC. Pertinent data are summarized in Table F-4.

User Skill Requirements - More than 70% of the respondents indicated that extensive ISD training would not be required to effectively apply handbook procedures. The response patterns of analysts and reviewers were essentially identical, and there were no marked differences as a function type of course. When analyst and reviewer data were partitioned by experience level, experienced analysts and reviewers agreed that extensive ISD training would not be required. Although inexperienced reviewers concurred in this judgment, inexperienced analysts felt that extensive training would be required. A majority of the Senior Review teams (51%) also felt that extensive ISD training would be required.

A majority of the analysts and reviewers (70%) felt that the handbook could be used most effectively by a skilled instructor with extensive field experience (see Item 8, Table F-4). There were no real differences in the response patterns of analysts and reviewers. Analysts in equipment oriented courses were more likely to agree that extensive experience was required than those in nonequipment oriented courses. There were no differences of opinion as a function of experience level. Senior reviewers generally agreed that a skilled instructor could use the handbook to maximum advantage.

Although a substantial majority of the respondents agreed that the handbook would be most useful in the hands of a skilled instructor, many also indicated that the procedures could be utilized by personnel without extensive ISD training. These data suggest that handbook procedures could be optimally exercised by experienced users. They also suggest that the handbook would be useful to less experienced training development personnel.

Manpower Issues - Since the handbook requires a cooperative effort between an analyst and reviewer, four Handbook Evaluation Survey items addressed manpower issues related to handbook procedures. A majority of respondents (90%) agreed that periodic SMS reviews are a good way of insuring accuracy and completeness. Response patterns did not differ as a function of type of course or experience level(see Item 40, Table F-4). Senior reviewers unanimously agreed that periodic reviews are a good way of insuring accuracy and completeness.

A related item, number 37, required respondents to comment on the desirability of working as two-member teams. Seventy percent of the analysts and reviewers thought that the team approach was sound (see Table F-4). Again, analyst and reviewer response patterns were highly similar, although analysts were slightly more positive. When the data were partitioned between equipment and nonequipment oriented courses, analysts from equipment oriented courses found the two-member team approach more suitable than did analysts from nonequipment oriented courses. A similar response pattern was obtained for reviewers. When the data were partitioned on the basis of experience level, the experienced analysts and reviewers were more positive about the desirability of two-member teams than were the inexperienced analysts and reviewers. The overall response pattern for the senior review teams approximated that of the analysts and reviewers.

Two items addressed the manpower requirement implications of the proposed handbook. Approximately 30% of the respondents felt that introduction of the handbook would not require additional manpower at the branch level (see Item 29, Table F-4). Although the analysts were predominantly uncertain about the increase in manpower, more than half the reviewers indicated that additional manpower would be required. When the data were partitioned by course orientation, 30% of the analysts from equipment oriented courses indicated that no additional manpower would be required, and 50% were uncertain. A less striking, but similar pattern, was obtained for analysts from nonequipment oriented courses. More than two-thirds of the reviewers from equipment oriented courses indicated that more manpower would be required. Reviewers from nonequipment oriented courses were of a similar opinion, although less strongly so. Partitioning the data by experience level resulted in response patterns that largely replicated the consolidated pattern. A majority of the senior reviewers (54%) indicated that adoption of the handbook would require additional manpower.

Item 26 required respondents to address the broader issue of whether or not the handbook would require additional resources. Although most analysts and reviewers were undecided, almost one-third felt that minimal additional resources would be required (see Table F-4). A comparison of analyst and reviewer response patterns indicated that analysts were more likely than reviewers to indicate that the handbook could be implemented with minimal additional resources. When the data were partitioned by type of course, analysts from equipment oriented courses were more positive than analysts from nonequipment courses that institution of handbook procedures would not require

additional resources. The converse was true for reviewers. There were very few differences between the subgroups when the data were partitioned according to experience level. Approximately two-thirds of the senior reviewers indicated that implementation of the handbook would require additional resources. It should be noted that the term "additional resources" was probably interpreted quite differently across groups of respondents, so these data are extremely difficult to interpret.

A majority of respondents agreed that the team approach to task analysis espoused in the handbook was sound. While many respondents expressed uncertainty about the manpower or resource impacts of handbook implementation, a majority of senior reviewers indicated that current manpower allotments would have to be increased before handbook procedures could be implemented. Our data suggest that satisfactory analyses can be accomplished and documented in accordance with handbook procedures within current manning levels.

Implementation Issues - The analysts and reviewers overwhelmingly agreed that the handbook would be useful when a course is undergoing major revision (see Item 20, Table F-4). There were no major differences between the analyst and reviewer response patterns. Since the analysts and reviewers were so strongly in agreement regarding the value of the handbook in course revision situations, negligible differences in response patterns emerged when the data were partitioned by course type and by level of experience. Senior reviewers were less positive than the analysts and reviewers that the handbook would be useful in the revision of existing courses.

Sixty-six percent of the analysts and reviewers felt that the handbook would be useful in the development of new courses (see Table F-4). Patterns of responding for the analysts and reviewers were essentially identical. When the data were partitioned by type of course, analysts from equipment oriented courses agreed more frequently than analysts from nonequipment oriented courses. Reviewers from equipment oriented courses were less likely to indicate that the handbook would be helpful in the development of a new course than were reviewers from nonequipment oriented courses. There were no marked differences in response patterns between analysts when the data were partitioned according to experience level. On the other hand, experienced reviewers were more likely to indicate that the handbook would be useful in developing a new course than were inexperienced reviewers. Fifty-eight percent of the senior reviewers agreed that handbook procedures would be useful for developing new courses.

Fewer than half the analysts and reviewers believed that the handbook would be applicable to the entire range of ATC courses (see item 7, Table F-4). The difference between analyst and reviewer response patterns was negligible, although analysts tended to select the scalar extremes more frequently than did reviewers. When the data were partitioned by course orientation, analysts and reviewers from equipment oriented courses agreed that the handbook would be applicable

to the entire range of ATC courses. The responses of analysts and reviewers from nonequipment courses were less positive. When the data were partitioned by experience level, experienced analysts and reviewers were more likely to indicate that the handbook would be applicable to the full range of ATC courses than were inexperienced analysts and reviewers. Fifty percent of senior reviewers indicated that the handbook would be applicable to the full range of ATC courses.

Eighty percent of the analysts and reviewers indicated that the handbook could be used as part of an ISD OJT program (see Item 11, Table F-4). There was no marked difference in analyst and reviewer response patterns. When analyst and reviewer data were partitioned by course orientation and by experience level, response patterns were essentially identical. Seventy-five percent of the senior reviewers agreed that the handbook would be useful as part of an ISD OJT program.

In summary, a majority of respondents indicated that the handbook would be useful in revising existing courses and developing new ones, and that it could be used as part of an ISD on-the-job training program. Fewer than half of the analysts and reviewers polled believed that handbook procedures were applicable to the full range of ATC courses. Once again, many respondents were probably required to speculate on courses outside their experience domain. Fifty percent of the senior reviewers indicated that handbook procedures had applicability to the full range of ATC courses.

SECTION VI

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Field test results indicated that the task analysis handbook and the procedures contained therein met the established design criteria of simplicity, validity, reliability, and time-efficiency/cost-effectiveness.

With regard to simplicity and usability, the ATC training development personnel who participated in the field test agreed that the:

- Physical structure and length of the handbook were acceptable.
- Text was comprehensibly written and the reading demands were appropriate.
- Terminology was, for the most part, clear and unambiguous.
- Handbook task analysis procedure was internally consistent and logical, and clearly presented.
- Textual explanations and supporting information, including examples, were adequate to allow application of the procedures.
- Examples included were realistic and meaningful.

It should be noted that a significant minority of field test participants, however, were not favorably disposed toward the documentation system. The negative opinions generally surfaced among reviewers and senior reviewers. More importantly, those who served as analysts reacted positively to the documentation system. This suggests that the flexibility and potency of the documentation system becomes obvious only after one has worked with it.

With regard to validity, independent evaluations (by ATC personnel) of task analyses performed using handbook procedures indicated that:

- PPRs, subtasks, and supporting skills and knowledges were accurately identified.
- The analyses were generally judged to be accurate and complete, and of satisfactory quality.
- The documentation produced would facilitate the development of learning objectives, tests, and the POI.

Analysts, reviewers, and senior reviewers were of the opinion that:

- o All steps in the handbook procedure were necessary for a complete and accurate task analysis.

- o Utilization of handbook procedures would result in complete, thorough, and accurate task analyses.

They also felt strongly that the documentation generated in applying handbook procedures would facilitate the completion of subsequent steps in the ISD process.

With regard to reliability, independent evaluations (by ATC personnel) of the task analyses performed using handbook procedures indicated that:

- o Modest degrees of correspondence were achieved between pairs of analyses at the PPR, subtask, and skill and knowledge levels when a stringent matching criterion was invoked.

- o Correspondence at the PPR and subtasks levels improved slightly with a lenient matching criterion.

More importantly, evaluative data indicated that application of handbook procedures consistently resulted in a satisfactory analysis and useful documentation. This type of consistency may be a better indicator of the reliability of the procedures than is degree of judged correspondence.

With regard to time-efficiency/cost-effectiveness, direct time expenditure comparisons suggested that handbook procedures are less time consuming than are current procedures. Additionally, the majority of analysts, reviewers, and senior reviewers were of the opinion that the handbook procedure would be less time consuming than the current procedure. Collectively, these groups also agreed that the handbook was appropriate for the intended user population and that the procedure contained therein was applicable to the revision of existing courses and the development of new ones.

After the field test data were analyzed and interpreted, a final draft of the handbook was prepared. A task analysis handbook conference was then held at Randolph AFB, Texas with representatives of ATC, OMC, AFHRL, and MDAC-St. Louis in attendance. All attendees, except those from MDAC-St. Louis, represented agencies which would be directly involved in the implementation of the handbook or the ultimate users of the products of task analysis efforts. Field test results were summarized and a group discussion followed the formal presentation. Several worthwhile revision suggestions were made, and these were eventually incorporated into the final version of the handbook. The Task Analysis Handbook has been published as an AFHRL Technical Report (AFHRL-TR-79-45(II)).

RECOMMENDATIONS

Based on the results of this research, it is recommended that ATC consider implementation of handbook procedures in support of the development of new resident technical courses, and the revision of existing resident technical training courses, when those courses are to undergo substantive revision. A substantive revision is defined as one in which 10% or more of the course content would be replaced or altered in some major way.

It is further recommended that ATC authorize an investigation of the feasibility of a centralized, computer-supported task analysis data bank. Training development personnel at the TTCs could enter and store locally approved task analysis documentation in the data bank using interactive computer terminals interfaced to a centrally located host. Training development and management personnel at the TTCs and ATC Headquarters could then interrogate the system and examine current task analysis documentation for resident technical training courses. A preliminary data bank design is detailed in Appendix G. This type of automated storage and retrieval system would provide a mechanism for improving management control of, as well as facilitating evaluation of, task analysis and training development efforts. It would also serve to establish institutional memory, minimize duplication of effort, and provide inexperienced training development personnel with a broad range of examples of documented analyses.

SECTION VII

REFERENCES

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APPENDIX A

DATA COLLECTION INSTRUMENTS

HANDBOOK EVALUATION SURVEY (HES)

Respondent's Name: _____

Respondent's Phone No.: _____

Technical Training Group Represented (No.): _____

INSTRUCTIONS

There is a series of statements on the following pages which solicits your opinions regarding the task analysis handbook, the procedures it outlines, and the practicality of those procedures for use in ATC. Please be as objective as possible is responding to these items, and check only one alternative for each item. Remember, we are genuinely interested in your opinions!

Space is also provided on the last page for you to raise important issues that you feel are not adequately addressed by survey items. Additionally, we welcome your suggestions for improving the handbook.

1. The type of task analysis documentation described in the handbook would be useful in interpreting and acting upon Field Evaluation Reports.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

2. Task analysis documentation produced using handbook procedures would be minimally useful in the preparation of written tests and performance checklists.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

3. The handbook would not be useful unless one had extensive training in ISD.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

4. The task analysis documentation generated in applying handbook procedures would be useful in developing learning objectives.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

5. The procedure described is too mechanical, analysts need more flexibility.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

FES-1

6. The use of the procedures described in the handbook would result in complete and thorough task analyses.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

7. The procedures described would not be applicable to the full range of courses taught by ATC.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

8. The handbook would be most useful in the hands of a skilled instructor with extensive field experience in his specialty.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

9. The procedures described in the handbook, if properly applied, would result in an accurate task analysis.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

10. Standardized application of handbook procedures across all types of courses would not produce high quality results consistently.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

-ES-2

11. The handbook would be useful as part of an ISD OJT program.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

12. Two task analysts, equal in subject matter expertise and field experience, using handbook procedures and working independently, would produce essentially the same results.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

13. Handbook examples provide <u>inadequate</u> support for the textual explanations.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

14. Handbook paragraphs should be numbered.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

15. The procedures for each step in the task analysis sequence are adequate to operate on the information generated the preceding step.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

-E3-3

16. Explanations are too superficial to permit use of the task analysis procedures.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

17. The handbook should contain a short explanation of how STSs and CTSs are developed.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

18. The explanations given for each step are sufficient to permit understanding of the task analysis procedures.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

19. Documentation requirements are excessive.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

20. It would make good sense to do this type of task analysis when a course is undergoing a major revision.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

21. Each step in the task analysis procedure provides the information necessary to perform the next step.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

22. Examples, figures, and tables should be placed in a separate, companion volume.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

23. The handbook task analysis procedures described would be best applied in developing new courses.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

24. Main points are easy to identify.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

25. Examples, figures, and tables should be integrated into the text.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

26. These task analysis procedures could be implemented in this Branch with minimal additional resources.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

27. Each step in the task analysis procedure leads logically to the next step.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

28. Figures and tables contain very little useful information.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

29. Adoption of this task analysis approach in this Branch would require additional manpower.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

30. The writing style is comprenensible.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

31. Reading demands are excessive.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

32. The examples provided are realistic and meaningful.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

33. The handbook is too long.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

34. Procedures are organized in such a way that they are easy to understand and apply.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

35. Handbook terminology is ambiguous and confusing.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

HES-7

36. Handbook concepts are clearly presented.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

37. Working in two-man teams is a waste of time and money.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

38. The task analysis handbook is readable.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

39. Converting STS/CTS items into behavioral statements is inappropriate.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

40. Periodic reviews by fellow Subject-Matter Specialists during the course of the analysis are a good way of insuring accuracy and completeness.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

41. It is unnecessary to prepare task diagrams; one can perform an adequate task analysis directly on the Task Analysis Documentation Form.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

42. The handbook provides an adequate number and range of examples.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
____	____	____	____	____

43. The best feature(s) of this handbook and these task analysis procedures is(are):

43. The worst feature(s) of this handbook and these task analysis procedures is(are):

HES-10

45. Do you have any comments or observations concerning areas not covered in the previous questions?

INNOVATION EVALUATION QUESTIONNAIRE (IES)

Respondent's Name: _____

Respondent's Phone No.: _____

Technical Training Group Represented (No.): _____

INSTRUCTIONS

Enclosure 1 of this package summarizes, in graphic form, the task analysis procedure that is being field tested by McDonnell Douglas Corporation for the Air Force Human Resources Laboratory and the Air Training Command (ATC). Scales 1, 2, 3, and 4 ask for your judgments regarding certain steps in that procedure. Be as objective as possible in your responses. We are truly interested in your opinions.

SCALE 1

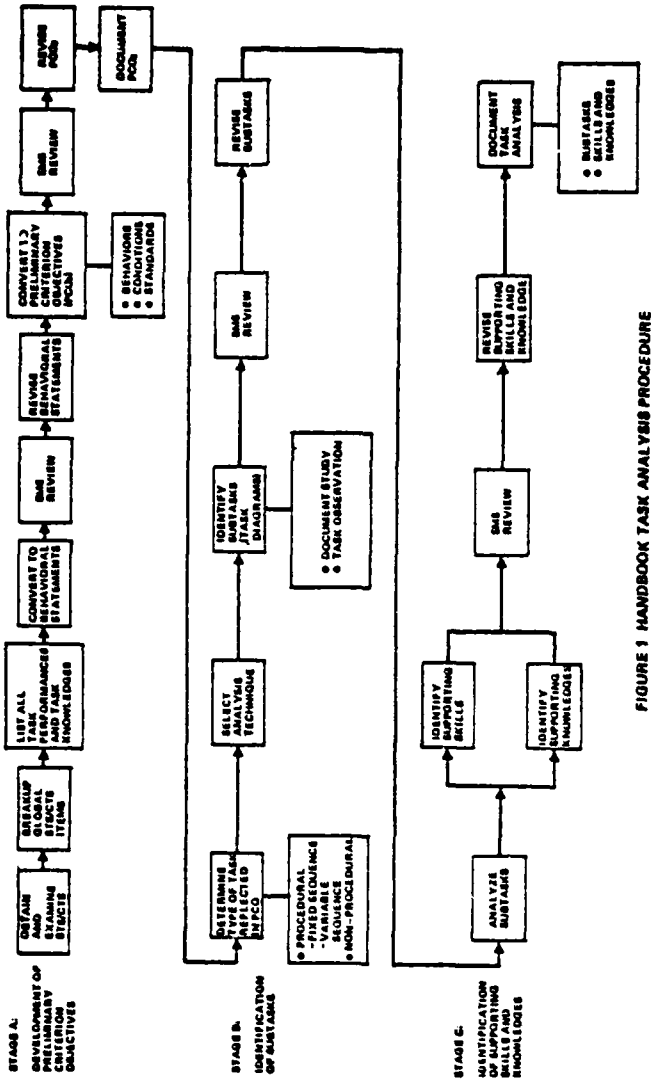

FIGURE 1 HANDBOOK TASK ANALYSIS PROCEDURE

IES-1

SCALE 1

For each step, please indicate whether or not that step is necessary for a complete and accurate task analysis.

Steps	Step Necessary: Yes	Step Necessary: No
1. Breakup Global STS/CTS Items	_____	_____
2. List All Task Performances and Task Knowledges	_____	_____
3. Convert to Behavioral Statements	_____	_____
4. Review By SMSs	_____	_____
5. Revise Behavioral Statements	_____	_____
6. Convert to Preliminary Criterion Objectives (PCOs)	_____	_____
7. Review By SMSs	_____	_____
8. Revise PCOs	_____	_____
9. Document PCOs	_____	_____
10. Determine Type of Task Reflected in PCO	_____	_____
11. Select Analysis Technique	_____	_____
12. Identify Subtasks (Task Diagrams)	_____	_____
13. Review By SMSs	_____	_____

IES-2

SCALE 1

	Step Necessary	
	Yes	No
14. Revise Subtasks	_____	_____
15. Analyze Subtasks	_____	_____
16. Identify Supporting Skills	_____	_____
17. Identify Supporting Knowledges	_____	_____
18. Review By SMSs	_____	_____
19. Revise Supporting Skills and Knowledges	_____	_____
20. Document Task Analysis	_____	_____

IES-3

SCALE 2

For each step, please indicate whether or not that step is performed in your organization as part of ATC's current task analysis procedure. For each step that is performed, please indicate how much time is spent accomplishing that step.

Steps	Step Performed as Part of Current Procedure		Relative Amount of Time Spent on Step		
	Yes	No	Large	Moderate	Small
1. Breakup Global STS/CTS Items	_____	_____	_____	_____	_____
2. List All Task Performances and Task Knowledges	_____	_____	_____	_____	_____
3. Convert to Behavioral Statements	_____	_____	_____	_____	_____
4. Review by SMSs	_____	_____	_____	_____	_____
5. Revise Behavioral Statements	_____	_____	_____	_____	_____
6. Convert to Preliminary Criterion Objectives (PCOs)	_____	_____	_____	_____	_____
7. Review by SMSs	_____	_____	_____	_____	_____
8. Revise PCOs	_____	_____	_____	_____	_____
9. Document PCOs	_____	_____	_____	_____	_____
10. Determine Type of Task Reflected in PCO	_____	_____	_____	_____	_____
11. Select Analysis Technique	_____	_____	_____	_____	_____

IES-4

SCALE 2

Steps	Step Performed as Part of Current Procedure: Yes	No	Relative Amount of Time Spent on Step: Large	Moderate	Small
12. Identify Subtasks (Task Diagrams)					
13. Review by SMSs					
14. Revise Subtasks					
15. Analyze Subtasks					
16. Identify Supporting Skills					
17. Identify Supporting Knowledges					
18. Review by SMSs					
19. Revise Supporting Skills and Knowledges					
20. Document Task Analysis					

IES-8

SCALE 3

Refer to your responses on Scale 2. For those steps that <u>are</u> performed under current procedures, please indicate if the <u>new</u> procedures would be more, equally, or less time consuming than current procedures.

Steps	New Procedures: More Time Consuming	New Procedures: Less Time Consuming	New Procedures: About the Same
1. Breakup Global STS/CTS Items			
2. List All Task Performances and Task Knowledges			
3. Convert to Behavioral Statements			
4. Review by SMSs			
5. Revise Behavioral Statements			
6. Convert to Preliminary Criterion Objectives (PCOs)			
7. Review by SMS			
8. Revise PCOs			
9. Document PCOs			
10. Determine Type of Task Reflected in PCO			
11. Select Analysis Technique			

TEC-6

SCALE 3

Steps	New Procedures: More Time Consuming	New Procedures: Less Time Consuming	About the Same
12. Identify Subtasks (Task Diagrams)			
13. Review by SMSs			
14. Revise Subtasks			
15. Analyze Subtasks			
16. Identify Supporting Skills			
17. Identify Supporting Knowledges			
18. Review by SMSs			
19. Revise Supporting Skills and Knowledges			
20. Document Task Analysis			

IES-7

SCALE 4

Refer to your responses on Scale 2. For each step that is performed in your organization as part of ATC's current task analysis procedure, think about how the handbook procedures compare with the way things are currently done. Are the handbook procedures better, worse or about the same as current procedures?

		Handbook Procedures		
	Steps	Better	Same	Worse
1.	Breakup Global STS/CTS Items	_____	_____	_____
2.	List All Task Performances and Task Knowledges	_____	_____	_____
3.	Convert to Behavioral Statements	_____	_____	_____
4.	Review by SMSs	_____	_____	_____
5.	Revise Behavioral Statements	_____	_____	_____
6.	Convert to Preliminary Criterion Objectives (PCOs)	_____	_____	_____
7.	Review by SMSs	_____	_____	_____
8.	Revise PCOs	_____	_____	_____
9.	Document PCOs	_____	_____	_____
10.	Determine Type of Task Reflected in PCO	_____	_____	_____
11.	Select Analysis Technique	_____	_____	_____

SCALE 4

	Handbook Procedures		
	Better	Same	Worse
12. Identify Subtasks (Task Diagrams)	_____	_____	_____
13. Review by SMSs	_____	_____	_____
14. Revise Subtasks	_____	_____	_____
15. Analyze Subtasks	_____	_____	_____
16. Identify Supporting Skills	_____	_____	_____
17. Identify Supporting Knowledges	_____	_____	_____
18. Review by SMSs	_____	_____	_____
19. Revise Supporting Skills and Knowledges	_____	_____	_____
20. Document Task Analysis	_____	_____	_____

TASK PERFORMANCE _____
TASK KNOWLEDGE _____
TEAM 1 _____
TEAM 2 _____

TASK ANALYSIS EVALUATION QUESTIONNAIRE (TAEQ)

Respondent's Name:_____

Respondent's Phone No.:_____

Technical Training Group Represented (No.):_____

INSTRUCTIONS

There is a series of statements on the following pages which solicits your opinions regarding a task (performance) (knowledge) analysis performed by Team (1) (2). In performing this analysis the team used the procedures and guidelines provided in a new task analysis handbook. When you evaluate the analysis, please be as objective as possible.

The last two questions ask you to evaluate the documentation system prescribed in the task analysis handbook. We would welcome any suggestions you have for improving the documentation system.

1. The Preliminary Criterion Objective(s) is (are) an accurate reflection of the STS item. (Circle one)

YES NO

2. If (1) NO, explain.

3. The subtask listing is accurate - it reflects the major steps that must be accomplished in performing the task. (Circle one)

YES NO

4. If (3) NO, explain.

TAEQ-1

5. The subtask listing is thorough and complete - it reflects all of the major steps that must be accomplished in performing the task. (Circle one)

YES NO

6. If (5) NO, explain.

7. All relevant supporting skills and knowledges are identified. (Circle one)

YES NO

8. If (7) NO, explain.

9. The task analysis, as documented, is accurate. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

10. The task analysis, as documented, is thorough and complete. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

11. How would you characterize the overall quality of these task analyses? (Check one)

_____ Excellent
_____ Very Good
_____ Good
_____ Fair
_____ Poor

12. The task analysis documentation would facilitate developing objectives and test items. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

13. The task analysis documentation would prove useful in preparing Part I of the Plan of Instruction. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

14. The task analysis documentation would facilitate preparation of Part II of the Plan of Instruction. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

15. A Subject-Matter Specialist other than the analyst could utilize the task analysis documentation to prepare learning objectives and test items. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

16. This kind of rigorous task analysis/documentation system is best applied when developing a new course or making a major revision in an existing course. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

17. Documenting task analyses at this level of detail is a sound way of insuring that only "need to know" information is included in a course. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

18. This kind of task analysis documentation would prove useful in interpreting and acting upon Field Evaluation Reports. (Check one)

_____ Strongly Agree
_____ Agree
_____ Undecided
_____ Disagree
_____ Strongly Disagree

NOTE: Disregard the next two questions if answered previously.

19. The best feature(s) of this documentation system is (are):

20. The worst feature(s) of this documentation system is (are):

TAEQ-5

TASK PERFORMANCE _____
TASK KNOWLEDGE _____

TASK ANALYSIS CORRESPONDENCE QUESTIONNAIRE (TACQ)

Respondent's Name:_____

Respondent's Phone No.:_____

Technical Training Group Represented (No.):_____

INSTRUCTIONS

There is a series of questions on the following pages which solicits your opinions regarding the correspondence between the two task (performance) (knowledge) analyses. These analyses were performed by two task analysis teams (working independently) using the procedures and guidelines provided in a new task analysis handbook. When evaluating the degree of correspondence between analyses, please be as objective as possible.

1. The Preliminary Criterion Objectives (PCOs) of Task Analysis #1 match closely the PCOs of Task Analysis #2.

YES NO

2. If (1) NO, note and describe the nature of the discrepancies.

3. There is a high degree of correspondence between the subtasks identified in Task Analysis #1 and the subtasks identified in Task Analysis #2.

YES NO

4. If (3) NO, note and describe the nature of the discrepancies. Explain major discrepancies.

TACO-1

5. The supporting skills and knowledges listed in Task Analysis #1 match, in all important respects, the supporting skills and knowledges listed in Task Analysis #2.

YES NO

6. If (5) NO, note and describe the nature of the discrepancies.

7. Task Analysis #1 and Task Analysis #2 are essentially identical in all major respects.

YES NO

TACQ-2

TIME ACCOUNTING FORM (TAF)

Center: _____ Date: _____

Group: _____ Type of Analysis: TP TK

Course: _____ TP = Task Performance

Team #: _____ TK = Task Knowledge

	Analyst	Reviewer	Total
Familiarization	_____	_____	_____
Stage 1	_____	_____	_____
Stage 2	_____	_____	_____
Stage 3	_____	_____	_____
Total	_____	_____	_____

TAF-1

APPENDIX B

BIOGRAPHICAL INFORMATION: FIELD TEST PARTICIPANTS

TABLE B-1 BIOGRAPHICAL INFORMATION: ANALYSTS

LACKLAND

Course	TA Team	Grade	Yrs. in AF	Present Position	Time in Position	Yrs. of Experience	Trng. In Addition To 75100
Crypto	1	E5	6	Inst.	2	3	75133
	2	E4	4	Inst.	2	1	-
Sec. Pol	1	E5	6	Inst.	3	2	75130
	2	E5	3	Inst.	0.50	1.50	75130
Eq. Oppor.	1	Capt	8	Curr. Dev. Sp	1	3	75130
	2	E7	17	*	0.50	8	-

LOWRY

Tech. Inst.	1	E5	11.50	Inst.	2.50	9	75130, 75160
	2	GS9	3	Tech. Writer	2	3	-
Inv[illegible]ment	1	E6	9	Inst.	3	9	75130
	2	E5	5	Inst.	5	2	-

SHEPPARD

Radiologic	1	E6	11	Inst.	0.50	6	75130
	2	E6	6	Inst.	-	6	-
Cable Spl.	1	E7	10	Inst.	3	7	75133
	2	E7	14	Inst.	6	8	75130
Progr. Specl.	1	E5	9	Inst.	*	6	75130, 75160
	2	E3	2	Inst.	1.50	1.50	-

* Missing Data

AD-A087 710 MCDONNELL DOUGLAS ASTRONAUTICS CO-ST LOUIS MO F/G 5/9
METHODS FOR COLLECTING AND ANALYZING TASK ANALYSIS DATA.(U)
JUL 80 A J ESCHENBRENNER, P B DEVRIES F33615-77-C-0076
UNCLASSIFIED AFHRL-TR-79-45(I) NL

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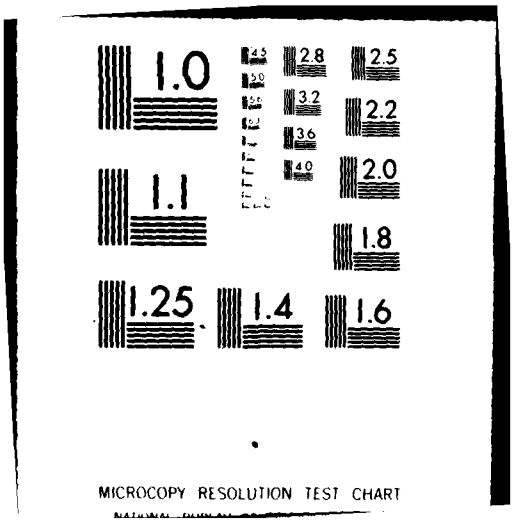
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2.8
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3.6
4.0
MICROCOPY RESOLUTION TEST CHART

TABLE B-2 BIOGRAPHICAL INFORMATION: REVIEWERS

LACKLAND

Course	TA Team	Grade	Yrs. in AF	Present Position	Time in Position	Yrs. of Experience	Trng. In Addition To 75100
Crypto.	1	E3	2	Inst.	1	0	-
	2	E3	2	Inst.	1	0	-
Sec. Pol.	1	E5	7	Inst.	3	7	75130
	2	E9	10.50	Inst.	1	10.50	75130
Eq. Oppor.	1	E5	10	*	2	6	75130
	2	E9	22	Asst. Crse. Chf.	0.50	7	75130

LOWRY

Tech. Inst.	1	E6	12	Inst.	3	3	75130, 75160, 75133
	2	GS11	7.50	Trng. Spec.	4.50	4.50	75130, 75160
Inv. Mgment.	1	GS9	5	Tech. Writer	0.50	0	75130
	2	E6	10	Supvr. Crse. Dev.	*	10	75130

SHEPPARD

Radiologic	1	E7	20	Grp. Supvr.	0.25	20	75130
	2	E5	4.50	Inst.	0.25	4	-
Cable Spl.	1	E6	7	Inst.	2	4	75130
	2	E7	8	Inst.	2.50	4	75130
Progr. Specl.	1	E6	16	Inst.	3	5	75130
	2	GS9	27	Inst.	2	2	75130

* Missing Data

TABLE B-3 BIOGRAPHICAL INFORMATION: TASK ANALYSIS EVALUATION TEAMS

LACKLAND

Course	Team Member	Grade	Yrs. in AF	Present Position	Time in Position	Yrs. of Experience	Trng. In Addition To 75100
Crypto.	1	GS11	26	Trng. Specl.	3	-	7500-3
	2	E8	15	Mats. Writer/ Supvr.	0.50	*	75130
Sec. Pol.	1	GS12	24	Curr. Dev. Chief	0.16	-	7500-3
	2	E7	15	Mats. Writer	3	*	75160
Eq. Oppor.	1	GS12	24	Curr. Dev. Chief	2	-	7500-3
	2	03	8	Curr. Dev. Sp.	1	3	75130
LOWRY							
Tech. Inst.	1	E7	16	Inst. Supvr.	0.33	2	-
	2	E7	14	Trgn. Tech.	1	4	75130
Inv. Mgment.	1	E5	7.50	Inst.	3.25	4	75130
	2	E5	5	Inst.	1.50	3.50	75130
	3	E5	6.50	Inst.	0.50	6	-

SHEPPARD: TA EVAL. TEAMS

Radiologic	1	E4	5	Inst.	0.25	4.50	-
	2	E5	12	Inst.	0.50	11	-
Cable Spl.	1	E5	4.50	Inst.	2.50	2	75130
	2	E5	6.50	Inst.	1	5.50	-

* Missing Data

TABLE B-3 (COMPLETED)

Course	Team Member	Grade	Yrs. in AF	Present Position	Time in Position	Yrs. of Experience	Trng. In Addition To 75100
Prog. Specl.	1	E6	16	Inst.	1	8	75130
	2	E6	18	Inst. Supvr.	2	6	75130

TABLE B-4 BIOGRAPHICAL INFORMATION: SENIOR REVIEW TEAMS

LACKLAND

School/Div./ Group	Team Member	Grade	Yrs. in AF	Present Position	Time in Position	Yrs. of Experience	Trng. In Addition To 75100
3270	1	GS12	27	Trng. Spec. Supvr.	2	-	75130, 7500-3
	2	E6	14	Inst. Supvr.	1	12	75130
3280	1	GS12	18	Trng. Spec.	7	-	75130, 75160
	2	E6	13	Tech. Writer	3	10	75130
3290	1	GS12	29	Trng. Spec.	29	-	7500-3
	2	E9	26	NCOIC, Curr. Dev.	1	24	75130
LOWRY							
3420	1	E7	18	Tech. Writer	0.08	16	7500-4
	2	GS12	22	Curr. Dev. Chf.	0.50	-	7500-3, 75130, 7500-2
3450	**	GS12	28	Trng. Spec.	18	-	7500-2, 7500-3
3450	1	GS11	18	Curr. Dev. Chf.	1	-	75130, 7500-3
	2	GS11	25	Trng. Spec.	3	-	75130, 7500-3
3460	**	GS11	26	Trng. Spec.	3	-	
SHEPPARD							
FAC DEV DIV	**	E6	15	Inst. Supvr.	1	2	75130, 75133
FAC DEV DIV	**	03	5	Inst.	0.25	9	7500-3

** Worked independently

TABLE B-4 (COMPLETED)

School/Div/ Group	Team Member	Grade	Yrs. in AF	Present Position	Time in Position	Yrs. of Experience	Trng. In Addition To 75100
SHCS	**	E5	6	Inst.	3	3	75130
SHCS	**	E6	17	ISD Specl.	1.50	15.50	75130, 75133
3780	**	E6	16	Inst.	.25	3	

** Worked independently

APPENDIX C

SIMPLICITY/USABILITY TABLES

TABLE C-1 JUDGMENTS REGARDING HANDBOOK SIMPLICITY/USABILITY

[Analysts = A; Reviewers = R; Equipment = Eq; Non-Equipment = NEq; Experienced = Ex; Inexperienced = IEx; Senior Review Team = SR]

[Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree (SD); n = number of cell entries]

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

a. Handbook Evaluation

1. Handbook Format

Item 14. Handbook paragraphs should be numbered.

				n	SA	A	U	D	SD
A + R				32	.00	.34	.25	.31	.09
A				16	.00	.38	.19	.25	.19
R				16	.00	.31	.31	.38	.00
	Course	Eq	A	6	.00	.50	.33	.17	.00
			R	6	.00	.33	.33	.33	.00
		NEq	A	10	.00	.30	.10	.30	.30
			R	10	.00	.30	.30	.40	.00
	Experience Level	IEx	A	8	.00	.50	.13	.00	.38
			R	8	.00	.13	.38	.50	.00
		Ex	A	8	.00	.38	.25	.38	.00
			R	8	.00	.50	.25	.25	.00
SR				11	.18	.18	.18	.36	.09

Item 22. Examples, figures, and tables should not be placed in a separate, companion volume.

				n	SA	A	U	D	SD
A + R				32	.25	.63	.03	.06	.03
A				16	.38	.50	.06	.06	.00
R				16	.13	.75	.00	.06	.06
	Course	Eq	A	6	.33	.67	.00	.00	.00
			R	6	.00	.83	.00	.17	.00
		NEq	A	10	.40	.40	.10	.10	.00
			R	10	.20	.70	.00	.00	.10
	Experience Level	IEx	A	8	.25	.50	.13	.13	.00
			R	8	.13	.75	.00	.13	.00
		Ex	A	8	.50	.50	.00	.00	.00
			R	8	.13	.75	.00	.00	.13
SR				12	.33	.58	.08	.00	.00

TABLE C-1 (CONTINUED)

Item 25. Examples, figures, and tables should be integrated into the text.

				n	SA	A	U	D	SD
A + R				32	.06	.38	.06	.34	.16
A				16	.06	.38	.06	.25	.25
R				16	.06	.38	.06	.44	.06
	Course	Eq	A	6	.00	.33	.17	.33	.17
			R	6	.00	.50	.17	.17	.17
		NEq	A	10	.10	.40	.00	.20	.30
			R	10	.10	.30	.00	.60	.00
	Experience Level	IEx	A	8	.00	.63	.00	.25	.13
			R	8	.13	.50	.00	.38	.00
		Ex	A	8	.13	.13	.13	.25	.38
			R	8	.00	.25	.13	.50	.13
SR				12	.00	.25	.17	.42	.17

Item 33. The handbook is of appropriate length.

				n	SA	A	U	D	SD
A + R				32	.09	.66	.13	.09	.03
A				16	.13	.56	.10	.13	.00
R				16	.06	.75	.06	.06	.06
	Course	Eq	A	6	.00	.83	.17	.00	.00
			R	6	.00	.67	.00	.17	.17
		NEq	A	10	.20	.40	.20	.20	.00
			R	10	.10	.80	.10	.00	.00
	Experience Level	IEx	A	8	.25	.38	.13	.25	.00
			R	8	.00	.63	.13	.13	.13
		Ex	A	8	.00	.75	.25	.00	.00
			R	8	.13	.88	.00	.00	.00
SR				11	.09	.64	.18	.00	.09

TABLE C-1 (CONTINUED)

2. Writing Style and Organization

Item 30. The writing style is comprehensible.

				n	SA	A	U	D	SD
A + R				32	.13	.72	.06	.09	.00
A				16	.13	.75	.06	.06	.00
R				16	.13	.69	.06	.13	.00
	Course	Eq	A	6	.00	1.00	.00	.00	.00
			R	6	.00	.67	.17	.17	.00
		NEq	A	10	.20	.60	.10	.10	.00
			R	10	.20	.70	.00	.10	.00
	Experience Level	IEx	A	8	.25	.50	.13	.13	.00
			R	8	.00	.63	.13	.25	.00
		Ex	A	8	.00	1.00	.00	.00	.00
			R	8	.25	.75	.00	.00	.00
SR				12	.00	.83	.00	.08	.08

Item 38. The task analysis handbook is readable.

				n	SA	A	U	D	SD
A + R				32	.22	.69	.06	.03	.00
A				16	.19	.63	.13	.06	.00
R				16	.25	.75	.00	.00	.00
	Course	Eq	A	6	.17	.83	.00	.00	.00
			R	6	.17	.83	.00	.00	.00
		NEq	A	10	.20	.50	.20	.10	.00
			R	10	.30	.70	.00	.00	.00
	Experience Level	IEx	A	8	.25	.50	.25	.00	.00
			R	8	.13	.88	.00	.00	.00
		Ex	A	8	.13	.75	.00	.13	.00
			R	8	.38	.63	.00	.00	.00
SR				12	.00	.75	.08	.08	.08

TABLE C-1 (CONTINUED)

Item 31. Reading demands are appropriate.

				n	SA	A	U	D	SD
A + R				32	.13	.72	.03	.13	.00
A				16	.13	.75	.00	.13	.00
R				16	.13	.69	.06	.13	.00
	Course	Eq	A	6	.00	1.00	.00	.00	.00
			R	6	.00	.67	.17	.17	.00
		NEq	A	10	.20	.60	.00	.20	.00
			R	10	.20	.70	.00	.10	.00
	Experience Level	IEx	A	8	.25	.50	.00	.25	.00
			R	8	.00	.63	.13	.25	.00
		Ex	A	8	.00	.00	.00	.00	.00
			R	8	.25	.75	.00	.00	.00
SR				12	.08	.58	.17	.00	.17

Item 35. Handbook terminology is clear and unambiguous.

				n	SA	A	U	D	SD
A + R				32	.09	.63	.09	.16	.03
A				16	.13	.56	.13	.13	.06
R				16	.06	.69	.06	.19	.00
	Course	Eq	A	6	.00	.83	.17	.00	.00
			R	6	.00	1.00	.00	.00	.00
		NEq	A	10	.20	.40	.10	.20	.10
			R	10	.10	.50	.10	.30	.00
	Experience Level	IEx	A	8	.25	.38	.13	.25	.00
			R	8	.00	.88	.00	.13	.00
		Ex	A	8	.00	.75	.13	.00	.13
			R	8	.13	.50	.13	.25	.00
SR				12	.00	.50	.08	.25	.17

TABLE C-1 (CONTINUED)

Item 36. Handbook concepts are clearly presented.

				n	SA	A	U	D	SA
A + R				32	.06	.63	.09	.22	.00
A				16	.13	.56	.13	.19	.00
R				16	.00	.69	.06	.25	.00
	Course	Eq	A	6	.00	.83	.17	.00	.00
			R	6	.00	.67	.17	.17	.00
		NEq	A	10	.20	.40	.10	.30	.00
			R	10	.00	.70	.00	.30	.00
	Experience Level	IEx	A	8	.25	.38	.25	.13	.00
			R	8	.00	.63	.13	.25	.00
		Ex	A	8	.00	.75	.00	.25	.00
			R	8	.00	.75	.00	.25	.00
SR				12	.00	.50	.17	.25	.08

Item 24. Main points are easy to identify

				n	SA	A	U	D	SD
A + R				32	.03	.63	.13	.19	.03
A				16	.00	.69	.13	.19	.00
R				16	.06	.56	.13	.19	.06
	Course	Eq	A	6	.00	.67	.33	.00	.00
			R	6	.17	.67	.00	.00	.17
		NEq	A	10	.00	.70	.00	.30	.00
			R	10	.00	.50	.20	.30	.00
	Experience Level	IEx	A	8	.00	.75	.13	.13	.00
			R	8	.13	.63	.00	.13	.13
		Ex	A	8	.00	.63	.13	.25	.00
			R	8	.00	.50	.25	.25	
SR				12	.00	.75	.00	.25	.00

TABLE C-1 (CONTINUED)

b. Procedures Evaluation

1. Consistency, Logic, and Documentation Requirements

Item 18. The explanations given for each step are sufficient to permit understanding of the task analysis procedures.

				n	SA	A	U	D	SD
A + R				32	.03	.66	.03	.28	.00
A				16	.06	.63	.00	.31	.00
R				16	.00	.69	.06	.25	.00
	Course	Eq	A	6	.00	.83	.00	.17	.00
			R	6	.00	.83	.00	.17	.00
		NEq	A	10	.10	.50	.00	.40	.00
			R	10	.00	.60	.10	.30	.00
	Experience Level	IEx	A	8	.13	.50	.00	.38	.00
			R	8	.00	.88	.00	.13	.00
		Ex	A	8	.00	.75	.00	.25	.00
			R	8	.00	.50	.13	.38	.00
SR				12	.00	.67	.00	.25	.08

Item 34. Procedures are organized in such a way that they are easy to understand and apply.

				n	SA	A	U	D	SD
A + R				32	.09	.59	.00	.31	.00
A				16	.06	.63	.00	.31	.00
R				16	.13	.56	.00	.31	.00
	Course	Eq	A	6	.00	.83	.00	.17	.00
			R	6	.17	.50	.00	.33	.00
		NEq	A	10	.10	.50	.00	.40	.00
			R	10	.10	.60	.00	.30	.00
	Experience Level	IEx	A	8	.13	.50	.00	.38	.00
			R	8	.13	.50	.00	.38	.00
		Ex	A	8	.00	.75	.00	.25	.00
			R	8	.13	.63	.00	.25	.00
SR				12	.00	.75	.00	.00	.25

TABLE C-1 (CONTINUED)

Item 39. Converting STS/CTS items into behavioral statements is appropriate.

				n	SA	A	U	D	SD
A + R				32	.19	.56	.13	.09	.03
A				16	.31	.38	.19	.06	.06
R				16	.06	.75	.06	.13	.00
	Course	Eq	A	6	.33	.50	.00	.00	.17
			R	6	.00	.83	.00	.17	.00
		NEq	A	10	.30	.30	.30	.10	.00
			R	10	.10	.70	.10	.10	.00
	Experience Level	IEx	A	8	.38	.38	.25	.00	.00
			R	8	.00	.75	.13	.13	.00
		Ex	A	8	.25	.38	.13	.13	.13
			R	8	.13	.75	.00	.13	.00
SR				12	.33	.58	.00	.08	.00

Item 17. The handbook should contain a short explanation of how STSs and CTSs are developed.

				n	SA	A	U	D	SD
A + R				32	.09	.41	.09	.38	.03
A				16	.19	.31	.06	.44	.00
R				16	.00	.50	.13	.31	.06
	Course	Eq	A	6	.33	.00	.00	.67	.00
			R	6	.00	.67	.00	.17	.17
		NEq	A	10	.10	.50	.10	.30	.00
			R	10	.00	.40	.20	.40	.00
	Experience Level	IEx	A	8	.25	.13	.13	.50	.00
			R	8	.00	.38	.25	.38	.00
		Ex	A	8	.13	.38	.00	.50	.00
			R	8	.00	.63	.00	.25	.13
SR				11	.00	.64	.09	.27	.00

TABLE C-1 (CONTINUED)

Item 27. Each step in the task analysis procedure leads logically to the next step.

				n	SA	A	U	D	SD
A + R				32	.06	.84	.03	.06	.00
A				16	.13	.81	.00	.06	.00
R				16	.00	.88	.06	.06	.00
	Course	Eq	A	6	.17	.83	.00	.00	.00
			R	6	.00	.83	.00	.17	.00
		NEq	A	10	.10	.80	.00	.10	.00
			R	10	.00	.90	.10	.00	.00
	Experience Level	IEx	A	8	.13	.88	.00	.00	.00
			R	8	.00	.88	.00	.13	.00
		Ex	A	8	.13	.75	.00	.13	.00
			R	8	.00	.88	.13	.00	.00
SR				12	.00	.67	.08	.25	.00

Item 21. Each step in the task analysis procedure provides the information necessary to perform the next step.

				n	SA	A	U	D	SD
A + R				32	.03	.69	.03	.25	.00
A				16	.06	.69	.06	.19	.00
R				16	.00	.69	.00	.31	.00
	Course	Eq	A	6	.00	.67	.17	.17	.00
			R	6	.00	.67	.00	.33	.00
		NEq	A	10	.10	.70	.00	.20	.00
			R	10	.00	.70	.00	.30	.00
	Experience Level	IEx	A	8	.13	.63	.13	.13	.00
			R	8	.00	.63	.00	.38	.00
		Ex	A	8	.00	.75	.00	.25	.00
			R	8	.00	.75	.00	.25	.00
SR				12	.00	.67	.08	.25	.00

TABLE C-1 (CONTINUED)

Item 15. The procedures for each step in the task analysis sequence are adequate to operate on the information generated in the preceding step.

				n	SA	A	U	D	SD
A + R				30	.10	.61	.06	.19	.00
A				15	.20	.60	.07	.13	.00
R				15	.00	.67	.07	.27	.00
	Course	Eq	A	6	.17	.83	.00	.00	.00
			R	6	.00	.50	.17	.33	.00
		NEq	A	9	.22	.44	.22	.22	.00
			R	9	.00	.78	.00	.22	.00
	Experience Level	IEx	A	8	.25	.63	.13	.00	.00
			R	8	.00	.50	.13	.38	.00
		Ex	A	7	.14	.57	.00	.29	.00
			R	7	.00	.86	.00	.14	.00
SR				12	.00	.58	.17	.17	.08

Item 5. The procedure described is sufficiently flexible.

				n	SA	A	U	D	SD
A + R				32	.06	.50	.22	.09	.13
A				16	.13	.50	.19	.06	.13
R				16	.00	.50	.25	.13	.13
	Course	Eq	A	6	.00	.67	.17	.00	.17
			R	6	.00	.67	.00	.17	.17
		NEq	A	10	.20	.40	.20	.10	.10
			R	10	.00	.40	.40	.10	.10
	Experience Level	IEx	A	8	.00	.75	.13	.13	.00
			R	8	.00	.63	.38	.00	.00
		Ex	A	8	.25	.25	.25	.00	.25
			R	8	.00	.38	.13	.25	.25
SR				11	.09	.64	.27	.00	.00

TABLE C-1 (CONTINUED)

Item 41. It is necessary to prepare task diagrams; one cannot perform an adequate task analysis directly on the Task Analysis Documentation Form.

				n	SA	A	U	D	SD
A + R				32	.03	.53	.16	.22	.06
A				16	.06	.63	.06	.19	.06
R				16	.00	.44	.25	.25	.06
	Course	Eq	A	6	.00	.67	.17	.17	.00
			R	6	.00	.67	.17	.17	.00
		NEq	A	10	.10	.60	.00	.20	.10
			R	10	.00	.30	.30	.30	.10
	Experience Level	IEx	A	8	.13	.63	.00	.25	.00
			R	8	.00	.38	.25	.25	.13
		Ex	A	8	.00	.63	.13	.13	.13
			R	8	.00	.50	.25	.25	.00
SR				11	.00	.27	.27	.36	.09

Item 19. Documentation requirements are reasonable.

				n	SA	A	U	D	SD
A + R				32	.03	.53	.13	.22	.09
A				16	.06	.56	.25	.13	.00
R				16	.00	.50	.00	.31	.17
	Course	Eq	A	6	.00	.67	.33	.00	.00
			R	6	.00	.50	.00	.33	.17
		NEq	A	10	.10	.50	.20	.20	.00
			R	10	.00	.50	.00	.30	.20
	Experience Level	IEx	A	8	.13	.63	.13	.13	.00
			R	8	.00	.50	.00	.13	.38
		Ex	A	8	.00	.50	.38	.13	.00
			R	8	.00	.50	.00	.50	.00
SR				12	.08	.25	.17	.42	.08

TABLE C-1 (CONTINUED)

2. Adequacy of Supporting Materials.

Item 28. Figures and tables contain much useful information.

				n	SA	A	U	D	SD
A + R				32	.28	.66	.00	.06	.00
A				16	.31	.63	.00	.06	.00
R				16	.25	.69	.00	.06	.00
	Course	Eq	A	6	.33	.67	.00	.00	.00
			R	6	.17	.83	.00	.00	.00
		NEq	A	10	.30	.60	.00	.10	.00
			R	10	.30	.60	.00	.10	.00
	Experience Level	IEx	A	8	.38	.63	.00	.00	.00
			R	8	.13	.88	.00	.00	.00
		Ex	A	8	.25	.63	.00	.13	.00
			R	8	.38	.50	.00	.13	.00
SR				12	.00	.75	.08	.08	.08

Item 16. Explanations are sufficiently comprehensive to permit use of the task analysis procedures.

				n	SA	A	U	D	SD
A + R				32	.03	.63	.16	.19	.00
A				16	.06	.63	.19	.13	.00
R				16	.00	.63	.13	.25	.00
	Course	Eq	A	6	.00	.67	.17	.17	.00
			R	6	.00	.50	.33	.17	.00
		NEq	A	10	.10	.60	.20	.10	.00
			R	10	.00	.70	.10	.20	.00
	Experience Level	IEx	A	8	.13	.63	.13	.13	.00
			R	8	.00	.38	.25	.38	.00
		Ex	A	8	.00	.63	.25	.13	.00
			R	8	.00	.88	.00	.13	.00
SR				12	.00	.67	.00	.25	.08

TABLE C-1 (CONTINUED)

Item 42. The handbook provides an adequate number and range of examples.

				n	SA	A	U	D	SD
A + R				32	.06	.47	.19	.25	.03
A				16	.13	.31	.19	.31	.06
R				16	.00	.63	.19	.19	.00
	Course	Eq	A	6	.00	.33	.17	.50	.00
			R	6	.00	.50	.33	.17	.00
		NEq	A	10	.20	.30	.20	.20	.10
			R	10	.00	.70	.10	.20	.00
	Experience Level	IEx	A	8	.25	.25	.25	.25	.00
			R	8	.00	.38	.38	.25	.00
		Ex	A	8	.00	.38	.13	.38	.13
			R	8	.00	.88	.00	.13	.00
SR				12	.00	.58	.08	.25	.08

Item 13. Handbook examples provide adequate support for the textual explanations.

				n	SA	A	U	D	SD
A + R				31	.03	.58	.10	.23	.06
A				16	.06	.63	.13	.06	.06
R				15	.00	.53	.07	.33	.07
	Course	Eq	A	6	.00	.50	.17	.17	.17
			R	6	.00	.67	.00	.17	.17
		NEq	A	10	.10	.70	.10	.10	.00
			R	9	.00	.44	.11	.44	.00
	Experience Level	IEx	A	8	.13	.63	.13	.00	.13
			R	8	.00	.50	.00	.38	.13
		Ex	A	8	.00	.63	.13	.25	.00
			R	7	.00	.57	.14	.29	.00
SR				12	.00	.67	.08	.00	.25

TABLE C-1 (CONCLUDED)

Item 32. The examples provided are relistic and meaningful.

				n	SA	A	U	D	SD
A + R				32	.09	.69	.09	.13	.00
A				16	.19	.56	.19	.06	.00
R				16	.00	.81	.00	.19	.00
	Course	Eq	A	6	.17	.67	.00	.17	.00
			R	6	.00	.67	.00	.33	.00
		NEq	A	10	.20	.50	.30	.00	.00
			R	10	.00	.90	.00	.10	.00
	Experience Level	IEx	A	8	.25	.38	.25	.13	.00
			R	8	.00	.75	.00	.25	.00
		Ex	A	8	.13	.75	.13	.00	.00
			R	8	.00	.88	.00	.13	.00
SR				12	.00	.75	.00	.17	.08

TABLE C-2 COMPARATIVE EVALUATION: PROPOSED VS. CURRENT PROCEDURES (STEPS CURRENTLY PERFORMED)*

STEP		PROPOSED PROCEDURE			
		BETTER THAN	SAME AS	WORSE THAN	n
1	BREAKUP GLOBAL STS/CTS ITEMS	.33	.55	.11	9
2	LIST ALL TASK PERFORMANCES AND TASK KNOWLEDGES	.33	.59	.08	12
3	CONVERT TO BEHAVIORAL STATEMENTS	.54	.39	.07	13
4	SMS REVIEW	.63	.37	.00	11
5	REVISE BEHAVIORAL STATEMENTS	.50	.50	.00	10
6	CONVERT TO PRELIMINARY CRITERION OBJECTIVES (PCO)	.55	.27	.18	11
7	SMS REVIEW	.67	.33	.00	9
8	REVISE PCO	.45	.55	.00	11
9	DOCUMENT PCO	.45	.27	.27	11
10	DETERMINE TYPE OF TASK REFLECTED IN PCO	.50	.50	.00	10
11	SELECT ANALYSIS TECHNIQUE	.50	.37	.13	8

*INNOVATION EVALUATION SURVEY: SCALE 4

TABLE C-2 (COMPLETED)

STEP		PROPOSED PROCEDURE: BETTER THAN	SAME AS	WORSE THAN	n
12	IDENTIFY SUBTASKS (TASK DIAGRAMS)	.75	.13	.13	8
13	SMS REVIEW	.60	.40	.00	5
14	REVISE SUBTASKS	.83	.17	.00	6
15	ANALYZE SUBTASKS	.63	.25	.13	8
16	IDENTIFY SUPPORTING SKILLS	.45	.45	.10	11
17	IDENTIFY SUPPORTING KNOWLEDGES	.42	.50	.08	12
18	SMS REVIEW	.59	.41	.00	7
19	REVISE SUPPORTING SKILLS AND KNOWLEDGE	.55	.44	.00	9
20	DOCUMENT TASK ANALYSIS	.62	.25	.13	8

APPENDIX D

VALIDITY TABLES

TABLE D-1 JUDGED ACCURACY OF TASK ANALYSES

(Proportion of Positive Responses)

		SUBTASKS		
	PCOs	ACCURATE	COMPLETE	SKILLS/KNOWLEDGES
TASK PERFORMANCE (n=16)	.75	.38	.44	.62
TASK KNOWLEDGE (n=16)	.75	.50	.50	.31
$\bar{X}$	.75	.44	.47	.47
EQUIPMENT (n=12)	.83	.58	.42	.50
NONEQUIPMENT (n=20)	.70	.35	.50	.45
$\bar{X}$	.75	.44	.47	.47

TABLE D-2 ACCURACY/COMPLETENESS OF TASK ANALYSES (OVERALL)

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree; (SD)]

	SA	A	U	D	SD
TASK ANALYSIS ACCURATE (n=32)	.19	.25	.03	.44	.10
TASK ANALYSIS COMPLETE (n=32)	.19	.25	.00	.44	.13
$\bar{X}$	.19	.25	.02	.44	.12

TABLE D-3 ACCURACY/COMPLETENESS OF TASK PERFORMANCE AND TASK KNOWLEDGE ANALYSES

TASK PERFORMANCE

	SA	A	U	D	SD
TASK ANALYSIS ACCURATE (n=16)	.19	.19	.06	.50	.06
TASK ANALYSIS COMPLETE (n=16)	.19	.19	.00	.50	.13
$\bar{X}$	.19	.19	.03	.50	.10

TASK KNOWLEDGE

	SA	A	U	D	SD
TASK ANALYSIS ACCURATE (n=16)	.19	.31	.00	.38	.13
TASK ANALYSIS COMPLETE (n=16)	.19	.31	.00	.38	.13
$\bar{X}$	.9	.31	.00	.38	.13

TABLE D-4 ACCURACY/COMPLETENESS OF EQUIPMENT ORIENTED AND NONEQUIPMENT ORIENTED TASK ANALYSES

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D): Strongly Disagree (SD)]

EQUIPMENT ORIENTED COURSES

	SA	A	U	D	SD
TASK ANALYSIS ACCURATE (n=12)	.08	.42	.08	.42	.00
TASK ANALYSIS COMPLETE (n=12)	.08	.33	.00	.50	.08
$\bar{X}$	.08	.38	.04	.46	.04

NONEQUIPMENT ORIENTED COURSES

	SA	A	U	D	SD
TASK ANALYSIS ACCURATE (n=20)	.25	.15	.00	.45	.15
TASK ANALYSIS COMPLETE (n=20)	.25	.20	.00	.40	.15
$\bar{X}$	.25	.18	.00	.43	.15

TABLE D-5 QUALITY OF TASK ANALYSES (OVERALL)

[Proportion of Respondents Selecting Each Alternative]

[Key: Excellent (E); Very Good (VG); Good (G); Fair (F); Poor (P)]

	E	VG	G	F	P
TASK ANALYSIS QUALITY (n=32)	.16	.16	.13	.35	.22

TABLE D-6 OVERALL QUALITY OF TASK PERFORMANCE AND TASK KNOWLEDGE ANALYSES

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[*Key: Excellent (E)*; Very Good (VG); Good (G); Fair (F); Poor (P)]

TASK PERFORMANCE

	E	VG	G	F	P
TASK ANALYSIS QUALITY (n=16)	.13	.19	.06	.50	.13

TASK KNOWLEDGE

	E	VG	G	F	P
TASK ANALYSIS QUALITY (*n*=16)	.19	.13	.19	.19	.31

TABLE D-7 OVERALL QUALITY OF EQUIPMENT ORIENTED AND NONEQUIPMENT ORIENTED TASK ANALYSES

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[Key: Excellent (E); Very Good (VG); Good (G); Fair (F); Poor (P)]

EQUIPMENT ORIENTED COURSES

	E	VG	G	F	P
TASK ANALYSIS QUALITY (n=12)	.00	.33	.17	.33	.17

NONEQUIPMENT ORIENTED COURSES

	E	VG	G	F	D
TASK ANALYSIS QUALITY (n=20)	.20	.05	.10	.35	.25

TABLE D-8 UTILITY OF TASK ANALYSES DOCUMENTATION

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree (SD)]

	SA	A	U	D	SD
FACILITATE DEVELOPMENT OF OBJECTIVES AND TEST ITEMS (n=32)	.19	.35	.16	.19	.13
FACILITATE DEVELOPMENT OF POI (PART I) (n=32)	.22	.47	.03	.19	.10
FACILITATE DEVELOPMENT OF POI (PART II) (n=32)	.19	.41	.06	.22	.13
FACILITATE DEVELOPMENT OF OBJECTIVES AND TEST ITEMS BY INDEPENDENT SMSs (n=32)	.16	.38	.13	.19	.15
INSURE THAT ONLY "NEED TO KNOW" INFORMATION IS INCLUDED IN COURSE (n=32)	.38	.53	.00	.06	.03
FACILITATE INTERPRETATION OF FIELD EVALUATION REPORTS (n=32)	.16	.75	.03	.03	.03
$\bar{X}$	.22	.48	.07	.15	.10

TABLE D-9 UTILITY OF TASK PERFORMANCE AND TASK KNOWLEDGE DOCUMENTATION

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[Task Performance (TP, Task Knowledge (TP)]

[Cell Frequency: n=16]

[Key: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), Strongly Disagree (SD)]

		SA	A	U	D	SD
FACILITATE DEVELOPMENT OF OBJECTIVES AND TEST ITEMS	TP	.19	.25	.25	.19	.13
	TK	.19	.44	.06	.19	.13
FACILITATE DEVELOPMENT OF POI (PART I)	TP	.25	.50	.00	.19	.06
	TK	.19	.44	.06	.19	.13
FACILITATE DEVELOPMENT OF POI (PART II)	TP	.19	.44	.00	.31	.06
	TK	.19	.38	.13	.13	.19
FACILITATE DEVELOPMENT OF OBJECTIVES AND TEST ITEMS BY INDEPENDENT SMS	TP	.13	.38	.19	.25	.06
	TK	.19	.38	.06	.13	.25
INSURE THAT ONLY "NEED TO KNOW" INFORMATION IS INCLUDED IN COURSE	TP	.38	.56	.00	.06	.00
	TK	.38	.50	.00	.06	.06
FACILITATE INTERPRETATION OF FIELD EVALUATION REPORTS	TP	.19	.69	.06	.06	.00
	TK	.13	.81	.00	.00	.06
$\bar{X}$	TP	.22	.47	.08	.18	.05
	TK	.21	.49	.05	.12	.14

TABLE D-10 UTILITY OF DOCUMENTATION FOR EQUIPMENT ORIENTED AND NONEQUIPMENT ORIENTED COURSES

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

[Equipment Oriented (Eq.); Nonequipment Oriented (NEq.)]

[Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree (SD)]

			SA	A	U	D	SD
FACILITATE DEVELOPMENT OF OBJECTIVES AND TEST ITEMS	n=12	Eq	.08	.67	.08	.17	.00
	n=20	NEq	.25	.15	.20	.20	.20
FACILITATE DEVELOPMENT OF POI (PART I)	n=12	Eq	.17	.75	.00	.08	.00
	n=20	NEq	.25	.30	.05	.25	.15
FACILITATE DEVELOPMENT OF POI (PART II)	n=12	Eq	.08	.58	.00	.33	.00
	n=20	NEq	.25	.30	.10	.15	.20
FACILITATE DEVELOPMENT OF OBJECTIVES AND TEST ITEMS BY INDEPENDENT SMSs	n=12	Eq	.00	.75	.08	.08	.08
	n=20	NEq	.25	.15	.15	.25	.20
INSURE THAT ONLY "NEED TO KNOW" INFORMATION IS INCLUDED IN COURSE	n=12	Eq	.08	.92	.00	.00	.00
	n=20	NEq	.55	.30	.00	.10	.05
FACILITATE INTERPRETATION OF FIELD EVALUATION REPORTS	n=12	Eq	.08	.83	.08	.00	.00
	n=20	NEq	.20	.70	.00	.05	.05
$\bar{X}$	n=12	Eq.	.08	.75	.04	.11	.00
	n=20	NEq.	.29	.32	.08	.17	.14

TABLE D-11 JUDGMENTS REGARDING HANDBOOK VALIDITY

[Analysts = A; Reviewers = R; Equipment - Eq; Non-Equipment - NEq; Experienced - Ex; Inexperienced - IEx; Senior Review Teams - SR]

[Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree (SD) n = number of entries]

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

Item 4. The task analysis documentation generated in applying handbook procedures would be useful in developing learning objectives.

				n	SA	A	U	D	SD
A + R				32	.28	.59	.06	.06	.00
A				16	.31	.56	.06	.06	.00
R				16	.25	.63	.06	.06	.00
	Course	Eq	A	6	.33	.67	.00	.00	.00
			R	6	.33	.50	.17	.00	.00
		NEq	A	10	.30	.50	.10	.10	.00
			R	10	.20	.70	.00	.10	.00
	Experience Level	IEx	A	8	.38	.50	.13	.00	.00
			R	8	.13	.63	.13	.13	.00
		Ex	A	8	.25	.63	.00	.13	.00
			R	8	.38	.63	.00	.00	.00
SR				11	.27	.55	.09	.09	.00

Item 2. Task analysis documentation produced using handbook procedures would be useful in the preparation of written tests and performance checklists.

				n	SA	A	U	D	SD
A + R				32	.06	.38	.13	.41	.03
A				16	.06	.31	.19	.38	.06
R				16	.06	.44	.06	.44	.00
	Course	Eq	A	6	.00	.33	.17	.33	.17
			R	6	.00	.50	.17	.33	.00
		NEq	A	10	.10	.30	.20	.40	.00
			R	10	.10	.40	.00	.50	.00
	Experience Level	IEx	A	8	.13	.13	.25	.50	.00
			R	8	.00	.38	.13	.50	.00
		Ex	A	8	.00	.50	.13	.25	.13
			R	8	.13	.50	.00	.38	.00
SR				12	.17	.42	.17	.25	.00

TABLE D-11 (CONTINUED)

Item 1. The type of task analysis documentation described in the handbook would be useful in interpreting and acting upon Field Evaluation Reports.

				n	SA	A	U	D	SD
A + R				31	.10	.55	.29	.06	.00
A				15	.07	.60	.27	.07	.00
R				16	.13	.50	.31	.06	.00
	Course	Eq	A	6	.17	.83	.00	.00	.00
			R	6	.17	.50	.33	.00	.00
		NEq	A	9	.00	.44	.44	.11	.00
			R	10	.10	.50	.30	.10	.00
	Experience Level	IEx	A	8	.00	.50	.50	.00	.00
			R	8	.13	.50	.38	.00	.00
		Ex	A	7	.14	.71	.00	.14	.00
			R	8	.13	.50	.25	.13	.00
SR				12	.08	.50	.17	.17	.08

Item 6. The use of the procedures described in the handbook would result in complete and thorough task analyses.

				n	SA	A	U	D	SD
A + R				31	.16	.32	.32	.19	.00
A				16	.25	.19	.31	.25	.00
R				15	.07	.47	.33	.13	.00
	Course	Eq	A	6	.33	.17	.50	.00	.00
			R	6	.00	.50	.33	.17	.00
		NEq	A	10	.20	.20	.20	.40	.00
			R	9	.11	.44	.33	.11	.00
	Experience Level	IEx	A	8	.25	.25	.13	.38	.00
			R	8	.00	.50	.25	.25	.00
		Ex	A	8	.25	.13	.50	.13	.00
			R	7	.14	.43	.43	.00	.00
SR				12	.00	.58	.17	.17	.08

TABLE D-11 (COMPLETED)

Item 9. The procedures described in the handbook, if properly applied, would result in an accurate task analysis.

				n	SA	A	U	D	SD
A + R				31	.16	.52	.23	.10	.00
A				16	.19	.56	.13	.13	.00
R				15	.13	.47	.33	.07	.00
	Course	Eq	A	6	.17	.67	.17	.00	.00
			R	6	.00	.50	.50	.00	.00
		NEq	A	10	.20	.50	.10	.20	.00
			R	9	.22	.44	.22	.11	.00
	Experience Level	IEx	A	8	.25	.50	.25	.00	.00
			R	8	.00	.63	.25	.13	.00
		Ex	A	8	.13	.63	.13	.13	.00
			R	7	.29	.29	.43	.00	.00
SR				12	.00	.75	.00	.17	.08

TABLE D-12 NECESSITY OF STEP
(Proportion Responding Positively)*
(n=27)

STEP		
1	BREAKUP GLOBAL STS/CTS	.89
2	LIST ALL TASK PERFORMANCES AND TASK KNOWLEDGES	.89
3	CONVERT TO BEHAVIORAL STATEMENTS	.85
4	SMS REVIEW	.75
5	REVISE BEHAVIORAL STATEMENTS	.74
6	CONVERT TO PRELIMINARY CRITERION OBJECTIVES (PCO)	.82
7	SMS REVIEW	.85
8	REVISE PCO	.82
9	DOCUMENT PCO	.85
10	DETERMINE TYPE OF TASK REFLECTED IN PCO	.82
11	SELECT ANALYSIS TECHNIQUE	.82
12	IDENTIFY SUBTASKS (TASK DIA-GRAMS)	.85
13	SMS REVIEW	.78

*INNOVATION EVALUATION SURVEY: SCALE 1

TABLE D-12 (CONCLUDED)

STEP		
14	REVISE SUBTASKS	.74
15	ANALYZE SUBTASKS	.82
16	IDENTIFY SUPPORTING SKILLS	.93
17	IDENTIFY SUPPORTING KNOWLEDGES	.89
18	SMS REVIEW	.82
19	REVISE SUPPORTING SKILLS AND KNOWLEDGES	.85
20	DOCUMENT TASK ANALYSIS	.85

APPENDIX E

RELIABILITY TABLES

TABLE E-1 JUDGED CORRESPONDENCE OF TASK ANALYSES (STRINGENT)

	PCOs	SUBTASKS	SKILLS/KNOWLEDGES	OVERALL
TASK PERFORMANCE (n=8)	.75	.25	.25	.25
TASK KNOWLEDGE (n=8)	.50	.38	.25	.38
WEIGHTED $\bar{X}$	.63	.32	.25	.31
EQUIPMENT (n=6)	.67	.16	.00	.16
NONEQUIPMENT (n=10)	.60	.40	.40	.40
WEIGHTED $\bar{X}$	.63	.32	.25	.31

TABLE E-2 JUDGED CORRESPONDENCE OF TASK ANALYSIS (LENIENT*)

	PCOs	SUBTASKS	SKILLS/KNOWLEDGES
TASK PERFORMANCE (n=8)	.88	.25	.25
TASK KNOWLEDGE (n=8)	.62	.50	.25
WEIGHTED $\bar{X}$	.75	.38	.25
EQUIPMENT (n=6)	.83	.16	.00
NONEQUIPMENT (n=10)	.70	.50	.40
WEIGHTED $\bar{X}$	.75	.38	.25

*LENIENT: FUNCTIONAL EQUIVALENCE

TABLE E-3 JUDGMENTS REGARDING HANDBOOK RELIABILITY

[Analysts = A; Reviewers = R; Equipment - Eq; Non-Equipment - NEq; Experienced - Ex; Inexperienced - IEx; Senior Review Teams - SR]

[Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree (SD); n - number of entries]

[Cell Entries: Proportion of Respondents Selecting Each Alternative]

Item 12. Two task analysts, equal in subject matter expertise and field experience, using handbook procedures and working independently, would produce essentially the same results.

				n	SA	A	U	D	SD
A + R				32	.09	.28	.28	.22	.13
A				16	.19	.19	.19	.25	.19
R				16	.00	.38	.38	.19	.06
	Course	Eq	A	6	.33	.33	.00	.17	.17
			R	6	.00	.50	.50	.00	.00
		NEq	A	10	.10	.10	.30	.30	.20
			R	10	.00	.30	.30	.30	.10
	Experience Level	IEx	A	8	.13	.25	.13	.13	.38
			R	8	.00	.50	.38	.13	.00
		Ex	A	8	.25	.13	.25	.38	.00
			R	8	.00	.25	.38	.25	.13
SR				12	.00	.50	.08	.33	.08

Item 10. Standardized application of handbook procedures across all types of courses would produce high quality results consistently.

				n	SA	A	U	D	SD
A + R				31	.03	.35	.32	.19	.10
A				16	.00	.25	.44	.19	.13
R				15	.07	.47	.20	.20	.07
	Course	Eq	A	6	.00	.33	.33	.17	.17
			R	6	.00	.50	.17	.17	.17
		NEq	A	10	.00	.20	.50	.20	.10
			R	9	.11	.44	.22	.22	.00
	Experience Level	IEx	A	8	.00	.13	.50	.25	.13
			R	8	.00	.63	.00	.25	.13
		Ex	A	8	.00	.38	.38	.13	.13
			R	7	.14	.29	.43	.14	.00
SR				12	.08	.33	.25	.17	.17

APPENDIX F

TIME-EFFICIENCY/COST-EFFECTIVENESS TABLES

TABLE F-1 TIME SPENT ON TASK ANALYSIS:
CURRENT VS. HANDBOOK PROCEDURES

CURRENT

BASELINE COURSE	POI HRS ANALYZED	TA TIME (HRS)	TA HRS/POI HR
AC&W Radar Rprmn.	650	1680	2.58
Command Post Specl.	138	576	4.17
Firefighting Vehicle Oper.	64	80	1.25
Crypto Equip. Rprmn.	970	9152	9.44
Food Service Specl.	22	96	4.36
			$\bar{X}$ = 4.36

HANDBOOK

FEASIBILITY TEST COURSE			
Cable Splicing Specl.	2.00	7:51	3.93
Radiologic Specl.	4.50	6:45	1.50
Inv. Mgment. Specl.	4.50	4:30	1.00
Crypto. Equip. Rprmn.	26.00	3:18	0.13
Programming Specl.	29.00	6:17	0.22
Security Specl.	5.20	2:07	0.40
Equal Oppor. & Trtment.	3.85	2:06	0.55
Tech. Instr.	6.50	2:51	0.48
			$\bar{X}$ = 1.03

TABLE F-2 RELATIVE AMOUNT OF TIME CURRENTLY SPENT ON EACH STEP*
(Cell Entries: Proportion of Respondents Selecting Each Alternative)
(n=14)

STEP		NONE	SMALL	MODERATE	LARGE	
1	BREAKUP GLOBAL STS/CTS ITEMS	.36	.28	.28	.07	
2	LIST ALL TASK PERFORMANCES AND TASK KNOWLEDGES	.14	.21	.64	.00	
3	CONVERT TO BEHAVIORAL STATEMENTS	.07	.14	.57	.21	
4	SMS REVIEW	.23	.31	.23	.23	(n=13)
5	REVISE BEHAVIORAL STATEMENTS	.28	.21	.50	.00	
6	CONVERT TO PRELIMINARY CRITERION OBJECTIVES (PCO)	.21	.14	.36	.28	
7	SMS REVIEW	.25	.17	.50	.08	(n=12)
8	REVISE PCO	.21	.28	.36	.14	
9	DOCUMENT PCO	.21	.14	.50	.14	
10	DETERMINE TYPE OF TASK REFLECTED IN PCO	.23	.31	.46	.00	(n=13)
11	SELECT ANALYSIS TECHNIQUE	.43	.36	.21	.00	

*INNOVATION EVALUATION SURVEY: SCALE 2

TABLE F-2 (CONCLUDED)

STEP		NONE	SMALL	MODERATE	LARGE
12	IDENTIFY SUPPORTING (TASK DIAGRAMS)	.43	.23	.14	.14
13	SMS REVIEW	.64	.14	.21	.00
14	REVISE SUBTASKS	.57	.36	.07	.00
15	ANALYZE SUBTASKS	.43	.21	.28	.07
16	IDENTIFY SUPPORTING SKILLS	.21	.21	.50	.07
17	IDENTIFY SUPPORTING KNOWLEDGES	.14	.21	.57	.07
18	SMS REVIEW	.50	.14	.28	.07
19	REVISE SUPPORTING SKILLS AND KNOWLEDGE	.36	.28	.36	.00
20	DOCUMENT TASK ANALYSIS	.36	.07	57	.00

TABLE F-3 TIME EXPENDITURE JUDGMENTS: PROPOSED VS. CURRENT PROCEDURES (STEPS CURRENTLY PERFORMED)*

(Cell Entries: Proportion of Respondents Selecting Each Alternative)

STEP		PROPOSED PROCEDURE MORE	EQUAL	LESS	n
1	BREAKUP GLOBAL STS/CTS ITEMS	.22	.55	.22	9
2	LIST ALL TASK PERFORMANCES AND TASK KNOWLEDGE	.33	.42	.25	12
3	CONVERT TO BEHAVIORAL STATEMENTS	.15	.54	.31	13
4	SMS REVIEW	.36	.28	.36	11
5	REVISE BEHAVIORAL STATEMENTS	.20	.40	.40	10
6	CONVERT TO PRELIMINARY CRITERION OBJECTIVES (PCO)	.19	.36	.45	11
7	SMS REVIEW	.11	.33	.55	9
8	REVISE PCO	.10	.45	.45	11
9	DOCUMENT PCO	.27	.27	.45	11
10	DETERMINE TYPE OF TASK REFLECTED IN PCO	.30	.40	.30	10
11	SELECT ANALYSIS TECHNIQUE	.13	.63	.25	8

*INNOVATION EVALUATION SURVEY: SCALE 3

TABLE F-3 (CONCLUDED)

			PROPOSED PROCEDURE		
12	IDENTIFY SUBTASKS (TASK DIA-GRAMS)	.50	.13	.37	8
13	SMS REVIEW	.00	.40	.60	5
14	REVISE SUBTASKS	.00	.50	.50	6
15	ANALYZE SUBTASKS	.37	.25	.37	8
16	IDENTIFY SUPPORTING SKILLS	.27	.55	.18	11
17	IDENTIFY SUPPORTING KNOWLEDGES	.25	.58	.17	12
18	SMS REVIEW	.00	.43	.57	7
19	REVISE SUPPORTING SKILLS AND KNOWLEDGE	.00	.55	.44	9
20	DOCUMENT TASK ANALYSIS	.13	.37	.50	8

*INNOVATION EVALUATION SURVEY: SCALE 3

TABLE F-4 JUDGMENTS REGARDING TIME-EFFICIENCY/COST-EFFECTIVENESS

(Analysts = A; Reviewers = R; Equipment = Eq; Non-Equipment = NEq; Experienced = Ex; Inexperienced = IEx; Senior Review Teams = SR).
(Key: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); Strongly Disagree (SD); n = number of entries).
(Cell Entries: Proportion of Respondents Selecting Each Alternative).

1. User/Skill Requirements

Item 3. To be useful, the handbook would not require extensive training in ISD.

				n	SA	A	U	D	SD
A + R				32	.13	.53	.06	.22	.06
A				16	.06	.56	.06	.25	.06
R				16	.19	.50	.06	.19	.06
	Course	Eq	A	6	.00	.67	.00	.17	.17
			R	6	.17	.50	.00	.33	.00
		NEq	A	10	.10	.50	.10	.30	.00
			R	10	.20	.50	.10	.10	.10
	Experience Level	IEx	A	8	.13	.38	.13	.25	.13
			R	8	.00	.63	.00	.38	.00
		Ex	A	8	.00	.75	.00	.25	.00
			R	8	.38	.38	.13	.00	.13
SR				11	.09	.27	.09	.18	.33

Item 8. The handbook would be most useful in the hands of a skilled instructor with extensive experience in his specialty.

				n	SA	A	U	D	SD
A + R				31	.19	.48	.16	.16	.00
A				16	.25	.44	.19	.13	.00
R				15	.13	.53	.13	.20	.00
	Course	Eq	A	6	.33	.50	.00	.17	.00
			R	6	.17	.50	.17	.17	.00
		NEq	A	10	.20	.40	.30	.10	.00
			R	9	.11	.50	.11	.22	.00
	Experience Level	IEx	A	8	.25	.50	.13	.13	.00
			R	7	.14	.57	.00	.29	.00
		EX	A	8	.25	.38	.25	.13	.00
			R	8	.13	.50	.25	.13	.00
SR				12	.42	.25	.08	.17	.08

TABLE F-4 (CONTINUED)

Item 29. Adoption of this task analysis approach in this Branch would not require additional man-power.

				N	SA	A	U	D	SD
A + R				31	.03	.26	.29	.35	.06
A				15	.00	.27	.47	.20	.07
R				16	.06	.25	.13	.50	.06
	Course	Eq	A	6	.00	.33	.50	.00	.17
			R	6	.00	.17	.17	.67	.00
		NEq	A	9	.00	.22	.44	.33	.00
			R	10	.10	.30	.10	.40	.10
	Experience Level	IEx	A	7	.00	.29	.57	.14	.00
			R	8	.00	.38	.13	.38	.13
		Ex	A	8	.00	.25	.38	.25	.13
			R	8	.13	.13	.13	.63	.00
SR				11	.00	.18	.27	.36	.18

Item 26. These task analysis procedures could be implemented in this Branch with minimal additional resourses.

				N	SA	A	U	D	SD
A + R				32	.06	.31	.41	.22	.00
A				16	.00	.44	.31	.25	.00
R				16	.13	.19	.50	.19	.00
	Course	Eq	A	6	.00	.50	.50	.00	.00
			R	6	.00	.17	.67	.17	.00
		NEq	A	10	.00	.40	.20	.40	.00
			R	10	.20	.20	.40	.20	.00
	Experience Level	Ex	A	8	.00	.50	.25	.25	.00
			R	8	.25	.00	.50	.25	.00
		IEx	A	8	.00	.38	.38	.25	.00
			R	8	.00	.38	.50	.13	.00
SR				12	.00	.17	.17	.50	.17

TABLE F-4 (CONTINUED)

3. Implementation Issues

Item 20. It would make good sense to do this type of task analysis when a course is undergoing major revision.

				n	SA	A	U	D	SD
A + R				32	.22	.63	.06	.06	.03
A				16	.25	.56	.13	.00	.06
R				16	.19	.69	.00	.13	.00
	Course	Eq	A	6	.33	.67	.00	.00	.00
			R	6	.17	.50	.00	.33	.00
		NEq	A	10	.20	.50	.20	.00	.10
			R	10	.20	.80	.00	.00	.00
	Experience Level	IEx	A	8	.38	.50	.13	.00	.00
			R	8	.13	.75	.00	.13	.00
		Ex	A	8	.13	.63	.13	.00	.13
			R	8	.25	.63	.00	.13	.00
SR				12	.25	.42	.08	.17	.08

Item 23. The handbook task analysis procedures described would be best applied in developing new courses.

				n	SA	A	U	D	SD
A + R				32	.16	.50	.13	.19	.03
A				16	.25	.44	.13	.13	.06
R				16	.06	.56	.13	.25	.00
	Course	Eq	A	6	.33	.50	.17	.00	.00
			R	6	.17	.17	.17	.50	.00
		NEq	A	10	.20	.40	.10	.20	.10
			R	10	.00	.80	.10	.10	.00
	Experience Level	IEx	A	8	.25	.50	.13	.00	.13
			R	8	.00	.50	.13	.38	.00
		Ex	A	8	.25	.38	.13	.25	.00
			R	8	.13	.63	.13	.13	.00
SR				12	.08	.50	.08	.25	.08

TABLE F-4 (CONTINUED)

Item 7. The procedures described would be applicable to the full range of courses taught by ATC.

				n	SA	A	U	D	SD
A + R				31	.03	.39	.26	.29	.03
A				16	.06	.31	.31	.25	.06
R				15	.00	.47	.20	.33	.00
	Course	Eq	A	6	.17	.50	.17	.17	.00
			R	6	.00	.67	.17	.17	.00
		NEq	A	10	.00	.20	.40	.30	.10
			R	9	.00	.33	.22	.44	.00
	Experience Level	IEx	A	8	.00	.25	.50	.13	.13
			R	8	.00	.38	.13	.50	.00
		EX	A	8	.13	.38	.13	.38	.00
			R	7	.00	.57	.29	.14	.00
SR				12	.00	.50	.25	.08	.17

Item 11. The handbook would be useful as part of an ISD OJT program.

				n	SA	A	U	D	SD
A + R				32	.41	.41	.09	.09	.00
A				16	.38	.44	.06	.13	.00
R				16	.44	.38	.13	.06	.00
		Eq	A	6	.17	.67	.00	.17	.00
			R	6	.50	.33	.17	.00	.00
		NEq	A	10	.50	.30	.10	.10	.00
			R	10	.40	.40	.10	.10	.00
		IEx	A	8	.38	.38	.13	.13	.00
			R	8	.25	.50	.13	.13	.00
		Ex	A	8	.38	.50	.00	.13	.00
			R	8	.57	.29	.13	.00	.00
SR				12	.17	.58	.00	.17	.08

TABLE F-4 (CONCLUDED)

2. Manpower Issues

Item 40. Periodic reviews by fellow Subject-Matter Specialists during the course of the analysis are a good way of insuring accuracy and completeness.

				n	SA	A	U	D	SD
A + R				32	.34	.56	.06	.03	.00
A				16	.38	.50	.06	.06	.00
R				16	.31	.63	.06	.00	.00
	Course	Eq	A	6	.33	.67	.00	.00	.00
			R	6	.17	.83	.00	.00	.00
		NEq	A	10	.40	.40	.10	.10	.00
			R	10	.40	.50	.10	.00	.00
	Experience Level	IEx	A	8	.25	.63	.13	.00	.00
			R	8	.13	.75	.13	.00	.00
		Ex	A	8	.50	.38	.00	.13	.00
			R	8	.50	.50	.00	.00	.00
SR				11	.36	.63	.00	.00	.00

Item 37. Working in two-person teams is time efficient and cost effective.

				n	SA	A	U	D	SD
A + R				31	.23	.45	.10	.16	.06
A				15	.27	.47	.07	.07	.13
R				16	.19	.44	.13	.25	.00
	Course	Eq	A	6	.33	.50	.00	.00	.17
			R	6	.00	.83	.00	.17	.00
		NEq	A	9	.22	.44	.11	.11	.11
			R	10	.30	.20	.20	.30	.00
	Experience Level	IEx	A	7	.43	.14	.14	.14	.14
			R	8	.00	.50	.13	.38	.00
		Ex	A	8	.13	.75	.00	.00	.13
			R	8	.38	.38	.13	.13	.00
SR				11	.27	.45	.18	.09	.00

APPENDIX G

PRELIMINARY DESIGN NOTES: TASK ANALYSIS DATA BANK

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Overview

This planning document describes an automated information storage and retrieval system (ISRS) for Air Training Command (ATC) task analysis data. The primary purposes of the proposed Task Analysis Data Bank (TADB) are to eliminate duplication of effort and to enhance management control of the training development process. In the sections that follow, the benefits of providing a TADB are delineated, the design process is discussed, a system description is provided, and an estimate of implementation cost is offered. It should be noted that the probability of achieving economy can be maximized by considering for inclusion in the TADB all Air Force (AF) specialities that are unclassified, have more than 300 job incumbents, and consist of 40 or more distinct tasks.

Benefits

ATC Technical Training Centers

- Eliminate redundant analyses, needless duplication of task analysis efforts, and enhance management and evaluation of task analysis efforts by requiring the production and preservation of standardized end-item documentation.
- Facilitate the design and revision of instructional materials and tests by providing an information base to support rational, objective decision-making.
- Improve the efficiency of course design and revision activities by providing novice analysts with a full range of task analysis examples.

ATC Headquarters

- Enhance management and evaluation of task analysis efforts.
- Enhance management and evaluation of course development and revision activities.
- Facilitate evaluation of training resources requests.

Other Organizations

- Occupational Measurement Center - Facilitate the development and revision of task inventories and Speciality Knowledge Tests.
- Extension Course Institute - Enhance management and evaluation of Career Development Course preparation and revision efforts.

- o Military Personnel Center - Support preparation of work center catalogs to facilitate on-the-job training in critical tasks.

- o Management Engineering Agency - Support development and evaluation of manpower standards.

Design Process

Objective - Design an automated ISRS for task analysis data.

Primary Constraints - The goal was to develop a TADB design that could be demonstrated and ultimately implemented at reasonable cost. To minimize hardware costs, the design was expected to propose utilization of a computer main frame already in the AF inventory. To minimize software development costs, attention was to be focused on operationally proven ISRSs.

Candidates - Four generic hardware systems were selected for consideration - the UNIVAC 1108, the Honeywell 1600, the Burroughs 3500 and the IBM 370/155. Four preliminary screening criteria were established to identify individual automated ISRSs for further consideration within the context of the TADB design effort. It was determined that the ISRS must

(1) Be compatible with one of the four main frames previously mentioned.

(2) Accommodate on-line entry, editing, and perusal of task analysis data by non-programmers.

(3) Provide a full range of report generation capabilities.

(4) Have a terminal and data base security protection system.

Of the 46 ISRSs surveyed by Fife, Rankin, Fong, Walker, and Marron (1974), five were UNIVAC-compatible (see Table G-1).

Final Trades and Selected Approach - Of the four hardware systems considered, a UNIVAC 1108, such as the one located at Brooks Air Force Base, is preferred for the proposed application. First of all, this system accommodates research and development (R and D) activities quite nicely. Secondly, several operationally proven ISRS are compatible with this main frame. Thirdly, the fact that the Comprehensive Occupational Data Analysis Programs (CODAP) system is already resident on a UNIVAC system would facilitate interfacing the CODAP and task analysis data bases in the event that subsequent analyses indicate the utility of such an interface. Lastly, the hardware procured and the software capabilities developed to support demonstration and evaluation of the TADB concept could be utilized in other R and D applications.

TABLE G-1

UNIVAC-COMPATIBLE ISRSs

System Name	Originator
DML	Computer Sciences Corp. (CSC) Information Network Div. 650 N. Sepulveda Blvd. El Segundo, CA 90245
EMISARI	Mathematics and Computation Laboratory Office of Emergency Preparedness 7706 Old Springhouse Rd. McLean, VA 22101
GIM	TRW Systems Group 7600 Colshire Drive McLean, VA 22101
MIRADS	Data Center Division NASA Marshall Space Flight Center, AL 35812
System 2000	MRI Systems Corp. P.O. Box 9968 Austin, TX 78766

Of the five operationally proven ISRS compatible with the UNIVAC 1108, System 2000 is the preferred ISRS for the proposed application for two reasons. First, it provides a great number of implementation alternatives in the event that the TADB demonstration proves successful. That is, System 2000 is compatible with a large number of main frames. Second, it is immediately available at no cost on the preferred computer system.

To summarize briefly, the selected approach calls for utilizing an AF owned UNIVAC 1108 and modifying System 2000 software to support demonstration and evaluation of the TADB.

System Description

Hardware - The system configuration will consist of a UNIVAC 1108 central main frame and 33 UNIVAC UNISCOPE 200 timesharing terminals - 28 with hard-copy printers. The terminals will be distributed across sites as shown in Figure G-1. At Lackland, Lowry, Sheppard, Keesler, and Chanute, preliminary plans call for providing a printer terminal for each Technical Training Group and a terminal without print capability for the cognizant headquarters activity.

Software

Overview - System 2000 is a hierarchical data base management system. The user specifies the data fields, structure, and data interrelationships. It is an English-like, user-oriented access language with a flexible report writing system, and it is easily adaptable to changing requirements. Indexes are used for rapid, efficient selection of qualified data. System 2000 is a comprehensive data base management system and is useful in batch and on-line applications to fulfill the data processing requirements of users. It provides for data base design and definition; data base creation; data manipulation; and data base administration.

System 2000 allows the data base administrator and designer to carry a users requirement through to full implementation in a minimal amount of time. The basic components of the data base definition are data items (called data elements) and data records (called repeating groups). The maximum sizes are: 16M repeating groups, 250 character fields, 32 levels and 500 fields. The data base administrator may specify items to be key. Data represented by key items are indexed to enhance the data qualifications and access process. Overflow areas are available for name and text fields to allow space savings.

Initial and incremental data base loading is accomplished with the Natural Language or Procedural Language Interface (PLI). Data loading may be accomplished through the use of Natural Language commands or the user may employ the LOAD command to load data from a predefined data file. Data base loading, editing and verification may be accomplished through the use of the PLI.

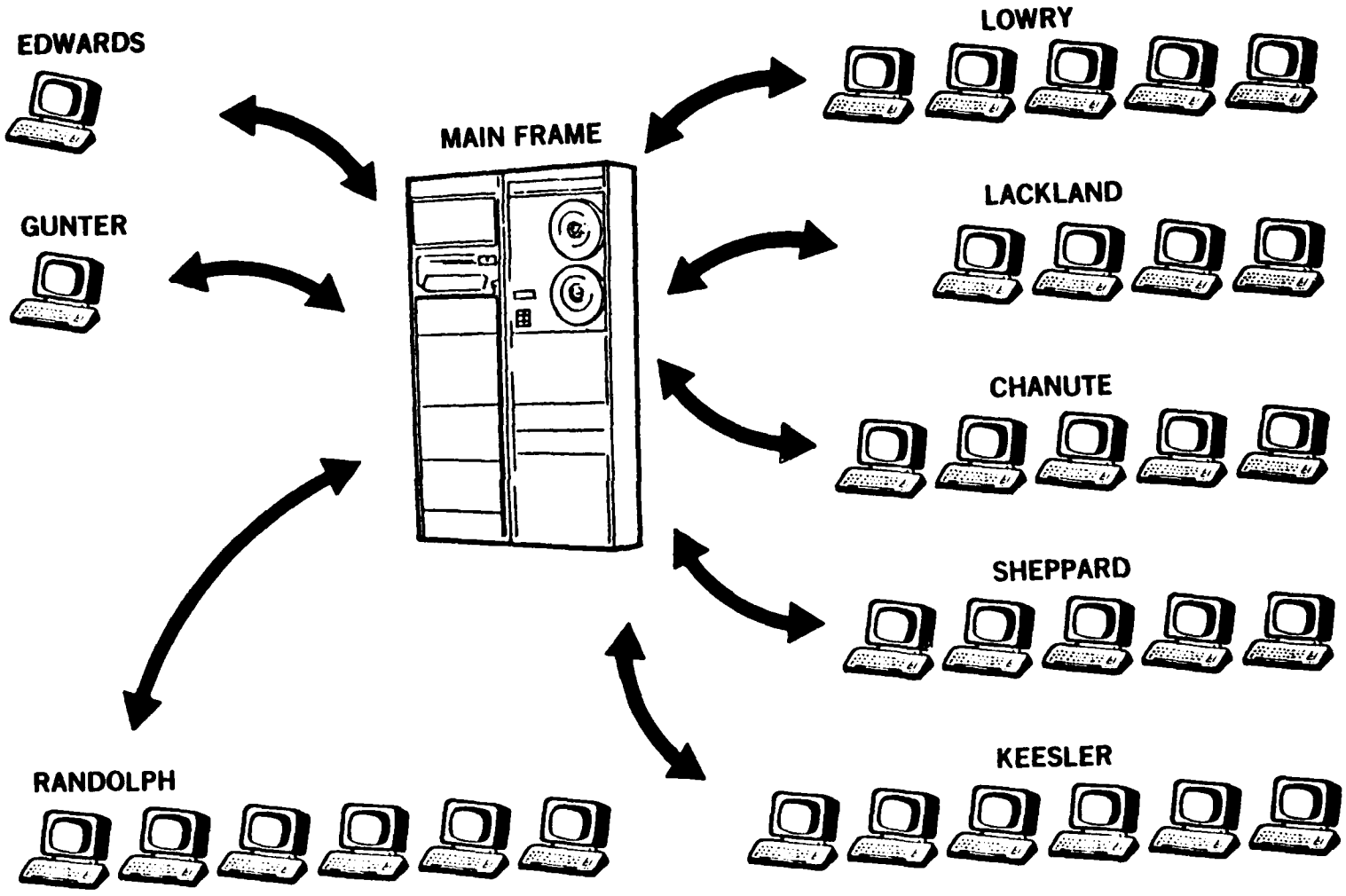

Figure G-1 TADB Network

The PLI enables the user to manipulate data in a System 2000 data base from a Procedural Language such as COBOL, FORTRAN, PL/1, and Assembly Language. The PLI is available for complex data retrieval, editing, verification, and loading of data and when multiple data base access is required. A maximum of four multiple simultaneous data bases can be created using the PLI.

Natural Language provides a complete set of commands for retrieving and updating data that require no special programming skills. The Natural Language Module includes Immediate Access Syntax and Queue Access Syntax. Immediate access indicates that data modifications are performed immediately. Queue access stacks the commands and performs the operations only after the issuance of a TERMINATE command. The advantage of the queue method is the resulting savings accrued with many data modifications. Multiple simultaneous access is available for retrieval but not for updates. Frequently used commands may be defined as strings and will be executed by typing the string designator.

The Report Writer feature allows the end user to prepare report specifications following a quickly learned report format. This feature is used to perform totaling, subtotaling and mathematical calculations. The results can be supplied in user designated format. The reports may be produced in timesharing or held as output for the printer.

System 2000 provides a wide range of features to insure data base security. A complete activity audit is maintained. Security is provided at remote terminals through terminal identification and passwords. Password security is applied at the system data base record and item levels. Password holders can be restricted on an item-by-item basis, as to retrieval authority, update authority, data selections or any combination. Validations are checked during update processing. The Update Log file records all update transactions against a data base and may be used to backtrack from the current data base to an earlier version. Data base backup is easily accomplished through magnetic tape copies or the use of an on-line file which holds the latest updated version. Data base restructuring, including additions or deletions of indexes, changing data or record descriptions, or modifying data structures is also available.

Data Base - The TADB is designed as a real-time, on-line, interactive ISRS. It will support multiple computer terminals and will provide quick on-line, interactive access to all information in the data base for authorized users. The proposed data base will provide a cost effective system which will eliminate duplication of training development efforts and enhance the control of training programs.

The TADB is designed to contain the following data elements:

COURSE NUMBER - a unique identifier assigned to each course of instruction
STS/CTS NUMBER - training standard identifier
STS/CTS REFERENCE - of an individual task
DUTY - to be addressed by the task
DATE - task schedule preparation date
ANALYST - developer of the training session
PROFICIENCY CODE - level of proficiency required to complete the task
STS TASK STATEMENT - subject matter addressed by the task
BEHAVIOR - the task to be performed
CONDITIONS - under which the task is performed
STANDARDS - to be met by task performance
REFERENCES - list of materials which may be useful for learning the task
STEP NUMBER - sequential number identifying major areas of the task
SUBTASK/DECISION - component procedure of the task
DECISION YES - step reference designator for "yes" decision question
DECISION NO - step reference designator for "no" decision question
GO TO STEP - step reference designator for sequential subtask progression
SKILLS - required to perform the subtask
KNOWLEDGES - required to perform the subtask

The proposed data base consists of 814 characters per unique entry (see Table G-2). These data elements contain all the information necessary to provide effective and efficient training development and control procedures. Data represented by key items are indexed to establish access criteria and to establish the data qualifications and access process. Through the declaration of keyed elements the user has more efficient access to items in the data base. Cross referencing of data is achieved through key item indexes which provide flexible data searching and browsing capabilities. Keyed elements in the TADB insure the effectiveness of retrieval and update activities by establishing commonalities of course number, STS number, STS reference, duty, proficiency, task statement, behavior, conditions, subtask, skills, and knowledges. Most importantly, training development personnel and researchers will have the capability to examine task, subtask, and skill and knowledge commonalities across courses and within and across career fields. The structure of TADB records is shown in Figure G-2 and a sample record is shown in Figure G-3. An estimated 200 courses will comprise the data base.

Performance Requirement - The TADB shall be operational from 0600 to 2400 hours on Monday through Friday.

Backup Capability - Users will be required to save a particular cycle of the data base and maintain a record of modifications made to the base cycle so that the current data base or any intermediate version can always be reproduced from the archival update recordings. The SAVE DATA BASE commands will be used to perform these backup procedures.

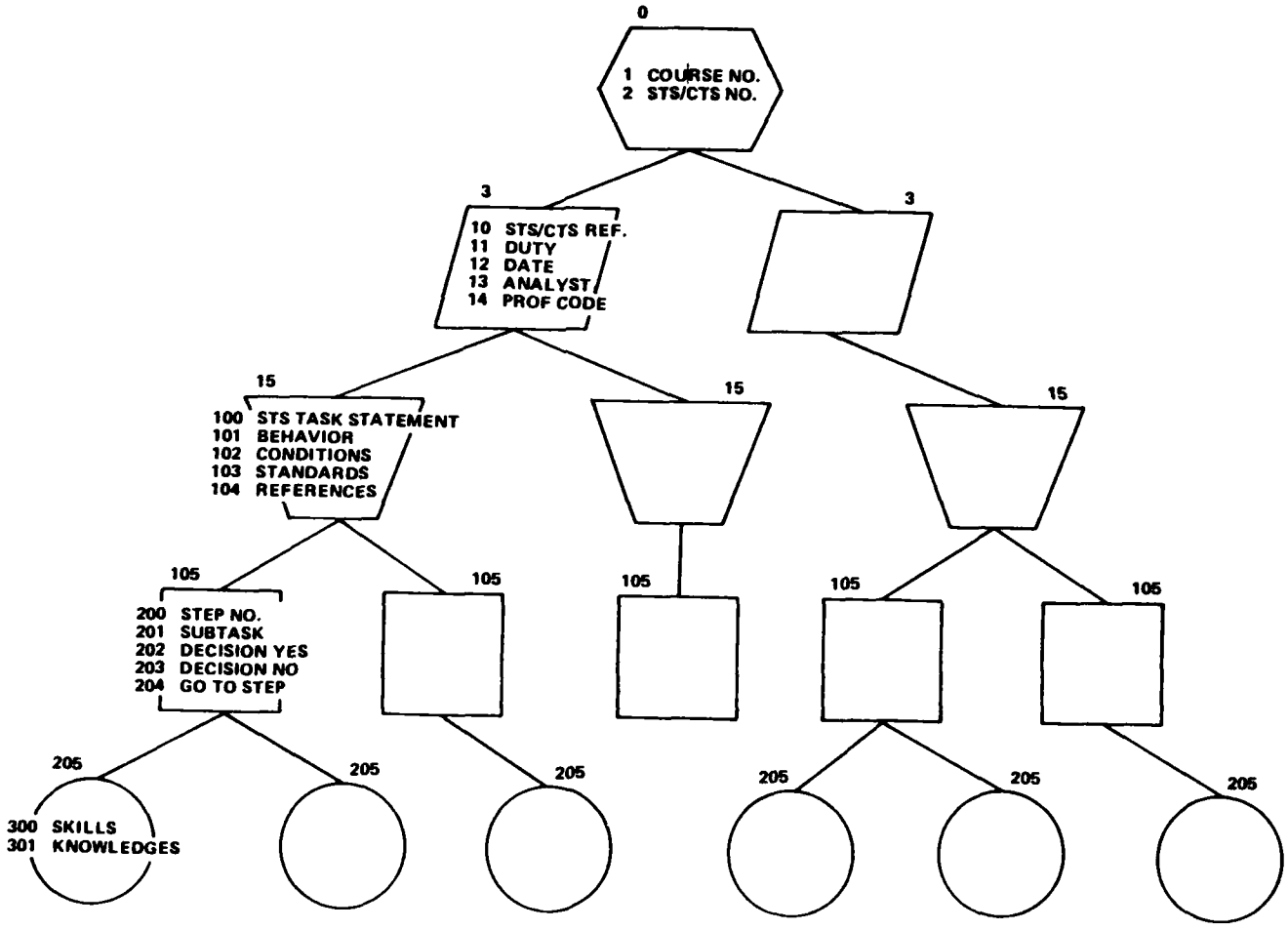

Figure G-2 TADB Record Structure

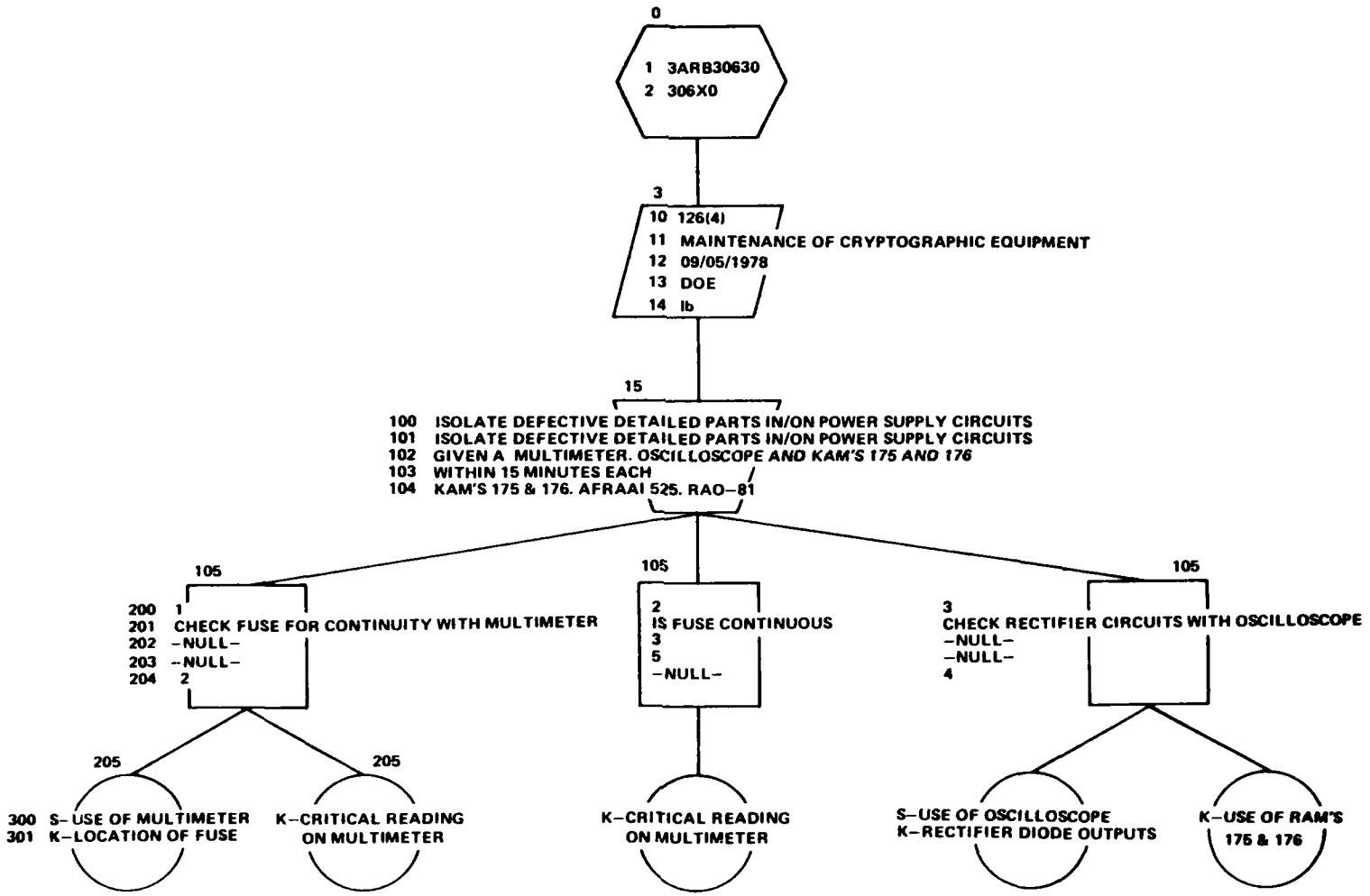

Figure G-3 TADB Sample Record

TABLE G-2
TADB RECORD DEFINITION

```
1 Course Number (key name X(12));                          max 200 occurrence
2 STS/CTS number (key name X(06));                         max 200 occurrence
3 reference group (rg);
     10 STS/CTS reference                          (key name X(06) in 3);
     11 duty                                       (key name X(100) in 3);
     12 date                                       (non-key date in 3);
     13 analyst                                    (non-key name X(25) in 3);
     14 proficiency code                           (key name X(02) in 3);
     15 task group (rg in 3);
           100 STS task statement                       (key name X(100) in 15);
           101 behavior                                 (key name X(100) in 15);
           102 condition                                (key name X(100) in 15);
           103 standards                                (key name X(100) in 15);
           104 references                               (key name X(100) in 15);
           105 step group (rg in 15);
                 200 step number                  (non-key integer 9(02) in 105);
                 201 subtask/decision             (key name X(75) in 105);
                 202 decision yes                 (non-key integer 9(02) in 105);
                 203 decision no                  (non-key integer 9(02) in 105);
                 204 go to step                   (non-key integer 9(02) in 105);
                 205 skills-inventory group (rg in 105);
                       300 skills                 (key name X(50) in 205);
                       301 knowledge              (key name X(50) in 205);
                                                        814 characters/entry
```

These recordings are kept on the Update File as directed by the user. The Update File is established by specifying the Update File tape identification when either a LOAD or SAVE Data Base command is issued. The tape identification maintains the relationship between the archival data base saved on tape and the associated Update File.

With the use of the Update File, a user may keep the archival data base on one tape and the update commands on another tape, such that when the cycles recorded on the Update File are applied to the archival data base, the resultant cycle number of the working data base is advanced from that of the cycle on the archival data base. The data cycle number of each copy will be the same. The archival TADB and Update File may be used to restore the data base to current status when required. Additionally, the data base can be copied from the random access device to tape daily as part of the standard operating installation backup procedure.

Operational Scenario - System 2000 provides interactive query and search capability geared for use by non-programmers. However, the syntax of the system is relatively complex and often obscure to the non-programmer user. A PLI program will be written to drive the data entry facilities of the system. Task analysts (non-programmers) will be prompted on an item by item basis for input. Data response will be thoroughly edited and validated for corrections within the constraints of each data element. Invalid data entries will be reported to the analyst with a message indicating the type of error. The analyst will be reprompted for the correct entry. The process will continue until a valid entry is input. Prompting will preserve the hierarchical data base structure -- course number must be established prior to entry of dependent components. Data entry will be performed interactively in System 2000 Immediate Access mode. Entry sequences will be as shown in the following examples.

DATA ENTRY/UPDATE - Example 1

```
ARE YOU ENTERING A NEW COURSE?
   Yes (or carriage return)
ENTER COURSE NUMBER:
   3ABR30630
ENTER STS/CTS REFERENCE:
   12b(4)
ENTER DUTY:
   Maintenance of Cryptographic Equipment
.
.
.
ENTER KNOWLEDGE:
   Location of fuse
```

DATA ENTRY/UPDATE - Example 2

```
ARE YOU ENTERING A NEW COURSE?
   Yes (or carriage return)
ENTER COURSE NUMBER:
   ABR90330
**INVALID COURSE NUMBER SYNTAX
ENTER COURSE NUMBER:
   3ABR90330
ENTER STS/CTS NUMBER:
   9030
**INVALID STS/CTS NUMBER SYNTAX
ENTER STS/CTS NUMBER:
   903X0
ENTER STS/CTS REFERENCE:
   15(6)
.
.
.
ENTER KNOWLEDGE:
   Correct positioning procedure
ARE YOU ENTERING A NEW COURSE?
   Stop            (STOP may be entered for any prompt
                    to discontinue entry for a course
--EXIT--            number)
```

DATA ENTRY/UPDATE - Example 3

```
ARE YOU ENTERING A NEW COURSE?
   Yes (or carriage return)
ENTER COURSE NUMBER:
   3ABR30630
COURSE NUMBER EXISTS IN DATA BASE
ENTER COURSE NUMBER:
   3ABR64530
.
.
.
```

Data base update requests will be performed in the same operational mode as data entry. Analysts will be prompted for input through an interactive PLI program. Inputs will be edited to maintain data base integrity. No dependent element may be accessed without proper identification of the parent component (course number). Invalid analyst responses will be reported back to the user for re-entry. Data update will be performed interactively in System 2000 Immediate Access mode as shown in the following example.

DATA ENTRY/UPDATE - Example 1

```
ARE YOU ENTERING A NEW COURSE?
  No
ENTER COURSE NUMBER:
  3ABR30630
ENTER COMPONENT ITEM TO BE UPDATED:
  Analyst
ENTER STS/CTS REFERENCE:
  12b(4)
ENTER ANALYST:
  Stephenson
ENTER COMPONENT ITEM TO BE UPDATED:
  Behavior
ENTER STS TASK STATEMENT:
  Isolate defective detailed parts in/on power supply
  circuits
ENTER BEHAVIOR:
  Same          (this response will duplicate the
                  previous entry)
 ENTER COMPONENT ITEM TO BE UPDATED:
   Subtask
ENTER STEP NUMBER:
  12
**STEP NUMBER 12 NOT FOUND
 ENTER STEP NUMBER:
   1
 ENTER SUBTASK:
  Check fuse for continuity with multimeter
 ENTER COMPONENT ITEM TO BE UPDATED:
  Stop
 --EXIT--
```

Queries upon the data base will also be accomplished through an interactive PLI program. The proposed program will enhance the current query and search capabilities of System 2000 and enable the analyst to refine the search/selection process. Search requests will be processed interactively. The number of selected occurrences ("hits") will be reported to the analyst, who may then issue recursive requests effectively narrowing (refining) search criteria. Requests to print the selected data may be issued at any point during the search. Enhanced key word processing techniques will also be developed to permit more efficient and effective use of complex keyword selector components. Inquiry sequences will be as shown in the following examples.

DATA INQUIRY - Example 1

```
ENTER COMPONENT ITEM TO BE SEARCHED:
   Duty
ENTER DUTY TO BE LOCATED:
   Maintenance of Cryptographic Equipment
ENTER COMPONENT ITEM TO BE SEARCHED:
   Stop
**6 ITEMS LOCATED
DO YOU WANT TO PRINT LOCATED ITEMS?
   No
ENTER DUTY TO BE LOCATED:
   Same          (this response will duplicate the
                  previous entry for Duty selection)
ENTER COMPONENT ITEM TO BE SEARCHED:
   Proficiency code
ENTER PROFICIENCY CODE TO BE LOCATED:
   1a, 1b
ENTER COMPONENT ITEM TO BE SEARCHED:
   Stop
**2 ITEMS LOCATED
DO YOU WANT TO PRINT LOCATED ITEMS?   Option:
   Yes                                Selected items may
                                      be automatically
                                      printed if less
                                      than 5
ENTER COMPONENT ITEMS TO BE PRINTED:
   Course number, STS/CTS number, Duty, Proficiency Code
   (enter ALL for complete list of selected data structure)
DO YOU WANT HARD-COPY (H), TERMINAL DISPLAY (T), OR
BOTH (B)?
   A
**INVALID ROUTING CODE
DO YOU WANT HARD-COPY (H), TERMINAL DISPLAY (T), OR
BOTH (B)?
   T

Terminal display of selected data items will occur.  Print
format will follow response to component items to be printed.

ENTER COMPONENT ITEM TO BE SEARCHED:
   Stop
--EXIT--
```

DATA INQUIRY - EXAMPLE 2

```
ENTER COMPONENT ITEM TO BE SEARCHED:
   Skills
ENTER SKILLS TO BE LOCATED:
   Use of multimeter
ENTER COMPONENT ITEM TO BE SEARCHED:
   Stop
** 12 ITEMS LOCATED
DO YOU WANT TO PRINT LOCATED ITEMS?
   Yes
ENTER COMPONENT ITEMS TO BE PRINTED:
   Course number, STS/CTS number, Duty, Proficiency
   Code, STS Task Statement, Step Group, Skills, Know-
   ledge (enter ALL for complete list of selected data
   structure)
DO YOU WANT HARD-COPY (H), TERMINAL DISPLAY (T), OR BOTH (B)?
   T
Terminal display of selected data items will occur.
Print format will follow response to component items to
be printed.
ENTER COMPONENT ITEM TO BE SEARCHED:
   Stop
---EXIT---
```

Investment Analyses

Preliminary analyses indicated that the initial investment associated with a full TADB network was approximately 2.5 times as great as that associated with a limited TADB network. The notion of a limited network to support concept demonstration and evaluation is appealing for three reasons. First, up-front costs can be minimized. Second, the utility of the TADB can be empirically evaluated. Third, operational procedures can be refined and implementation plans formulated prior to the commitment of additional resources. Requirements for a TADB concept demonstration are minimal. Three remote sites (Technical Training Centers), each with one resident technical training course scheduled for substantive revision, would provide a sufficient TADB test Bed.

Conclusion and Recommendation

Preliminary analyses indicate that a TADB can be implemented using state-of-the-art hardware and an operationally proven software package. It is expected that the potential cost reduction and avoidance benefits associated with implementing the TADB far outweigh the modest expenditure required to support concept demonstration and evaluation. It is recommended, therefore, that the AF consider implementation of a limited TADB network as a first step in assessing the feasibility and utility of a full TADB network.

REFERENCE

Fife, D. W., Rankin, K., Fong, E., Walker, J. C., & Marron, B. A. A Technical Index of Interactive Information Systems (NBS Technical Note 819). Washington: National Bureau of Standards, U.S. Department of Commerce, 1974.

APPENDIX H

GLOSSARY OF TERMS

LIST OF ACRONYMNS

AF	Air Force
AFB	Air Force Base
AFHRL	Air Force Human Resources Laboratory
AFM	Air Force Manual
AFP	Air Force Pamphlet
ATC	Air Training Command
CODAP	Comprehensive Occupational Data Analysis Programs
CRI	Criterion-Referenced Instruction
CTS	Course Training Standard
FER	Field Evaluation Reports
IPISD	Interservice Procedures for Instructional System Development
ISD	Instructional System Design
ISRS	Information Storage and Retrieval System
MAC	Military Aircraft Command
MAJCOM	Major Command
MDAC-S	McDonnell Douglas Astronautics Company - St. Louis
OJT	On-the-Job Training
OMC	Occupational Measurement Center
OS	Occupational Survey
OSR	Occupational Survey Report
PCO	Preliminary Criterion Objective
PLI	Procedural Language Interface
POI	Plan of Instruction
PPR	Preliminary Peformance Requirement
R and D	Research and Development
SAC	Strategic Air Command
SMS	Subject Matter Specialist
STS	Speciality Training Standard
TAC	Tactical Air Command
TADB	Task Analysis Data Bank
TK	Task Knowledge
T.O.	Technical Order
TP	Task Performance
TTC	Technical Training Center
TTG	Technical Training Group